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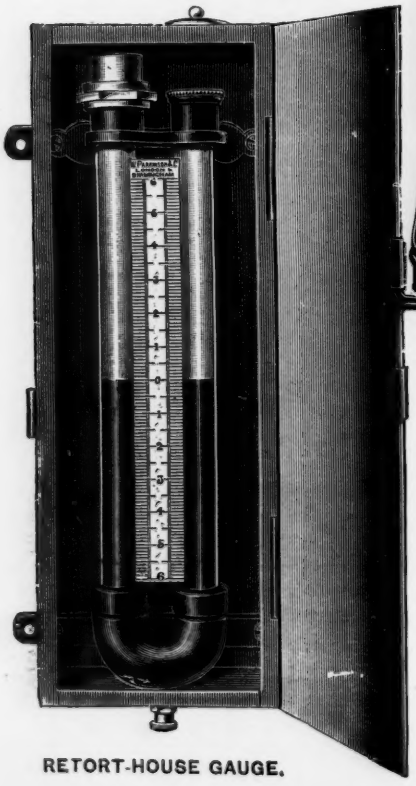

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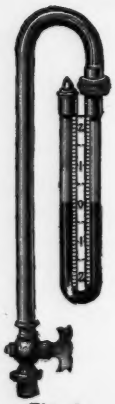

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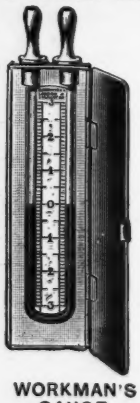

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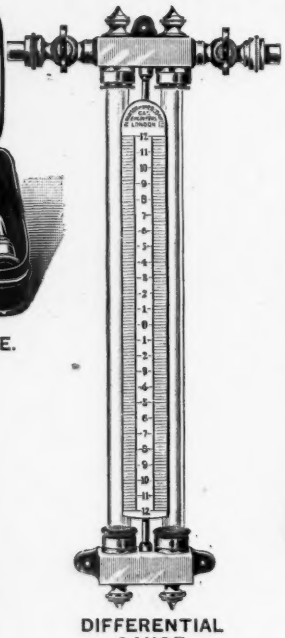

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Fig. 5B.

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EDITORIAL NOTES—GAS, &c.

The Publicity Committee.

THE Gas Publicity Committee were in conference on Monday of last week; and it is understood that a good programme of business and procedure was discussed. In regard to the definite contribution to the funds, the position at this stage, considering there has been some misapprehension, is not by any means disappointing; and it is now hoped that the matter and position will be again reviewed by those gas administrations who have already determined to stand aside from this effort in a common cause, with the result that the first determination will be reversed. It was announced at the meeting that there are many Boards of Directors and Committees who have not yet had the matter before them for consideration; some are still considering it; others are awaiting developments to ascertain what other undertakings are doing (the force of example evidently exists in the gas industry); while some again have declined to subscribe, and many of these the Committee hear have done so entirely owing to misunderstanding. From these it is therefore hoped to gain some good supporters when the matter is put before them in a proper way. Among other politic decisions, it has been resolved by the Committee to address a further letter to Chairmen, Engineers, and Secretaries, which letter will embrace an invitation to each gas undertaking to appoint a representative to attend a meeting to be held in London early in April, at which the whole matter will be discussed, and the necessary steps taken to start the campaign. There is pleasure in finding the Committee have resolved not to let interest in the movement sink, through want of proper stimulation. We again ask all the supporters of the project to use their personal influence to aid the Committee in getting together a strong and formidable backing of gas undertakings; and further, and with earnestness, we urge all those executive officers who have not been particularly in sympathy with the scheme to revolve it in mind once more, and, if it be possible, to regard it favourably—if only to the extent of promising it some support for a period.

In the Past, the Present, and the Future.

IT was an eminently practical address with which Mr. J. H. Brown, of Nottingham, last Thursday inaugurated his year of office as President of the Midland Association of Gas Engineers and Managers. When we reflect upon the prominent position in professional interest that Mr. Brown has been forced into through circumstances not of his own making, and bear in mind the fact that he has filled this position with distinguished credit to himself and the undertaking he has served, and is serving, with so much zeal, the first part of the deliverance may be taken to be something more than a mere recital of experiences; at least those of professional intuition and training will so regard it. The fact stands out distinctly that the position of the Nottingham gas supply was not what it should have been when first Mr. Brown took charge. Complaint was loud and frequent; and it was justified. The fact stands out with equal distinctness to-day that complaint has been silenced. This means that out of chaotic conditions (though works and distribution system are not, and cannot be, what Mr. Brown would desire if he were planning them *de novo*) order has been restored; and it has only been through engineering and organizing ability that this has been accomplished. It is part of the pleasures of the journalistic office to accord honour where honour is due; and this we do unreservedly in the present instance.

We will not specify the circumstances that gave rise to complaint through a distribution system of which there were no complete graphic records when Mr. Brown took office, and which therefore brought upon him the additional misfortune of having to attack and probe a condition of things of which no full account could be laid before him. It was obviously hard work to achieve success; and several plans had to be adopted to remedy the widely differing pressures at the consumers' services, on account of the greatly varying topographical characteristics of Nottingham. In such matters, local conditions must largely govern practice; and therefore it may be accepted that what was done in the case of Nottingham—it having been successful in giving satisfaction where dissatisfaction existed before—was the best under the circumstances. Taking a general view of the work of the distribution department, the President states experience, which is impregnated with advice, as to the importance and good effects of looking into the utmost detail in the organization and general practices of the department. There is economy in employing only the best materials; there is also economy in wise supervision and careful treatment of men. The conscientious workman prefers supervision that assists him in his work; but he resents the arbitrary surveillance that is all too often met with. The latter has an ultimate bad effect; the former is conducive to good character and good work all round. The conscientious worker himself is benefited by the would-be shirker being kept up to a fair day's result from his labour. Through the resultant economies of the introduction of good organization in the distribution department, the Nottingham Corporation Gas Committee have been able to afford a substantial increase in wages to the men. This is as things should be. He would be a dullard who could not appreciate this form of effect from the introduction of a new order of things which insists on good work and disciplinary conduct. Through such results the gas undertaking benefits. With reorganization and supervision extending to the canalization, a reduction of unaccounted-for gas has been effected in eight years from 7·42 to 4·5 per cent. This means money. The benefit passes on to the consumers in better service and in cheaper gas. Good organization and supervision scatter their advantages broadly.

When we come to the section of the address in which Mr. Brown deals with the problems upon which he has been engaged on the works in bringing about a better state of things, we find again that the existing conditions are not in harmony with the notions of the Engineer. This is often the case. Works of large extent cannot be abandoned; and the engineer has to make the best of his circumstances. This is precisely what is being done at Nottingham as opportunity favours. The sectionizing of the gas-works is a prudent step; it facilitates methodical procedure, the detection of weaknesses, the adoption of remedial measures, and the carrying out of improvements. Mr. Brown has to labour under the disadvantage of having to deliver to consumers gas of fairly high candle power. Yet his inclinations are in the direction of gas in which sperm value is not the important consideration, but a reasonable calorific power. His inclinations, in fine, are set in the direction of a comparatively free and open sphere for the gas industry, without the *cul de sacs* constructed by the antiquated notions of our Legislature. But regarding the plant producing the prime commodity, the inclined retort has obviously suffered depreciation in the affections of the President; and the horizontal retort, worked by some of the older forms of machinery, is giving (at Nottingham) a better all-round return than when it is worked by the modern rivals. But here again conditions have to be weighed. The best under particular conditions is what is required; and in works equipment there can be no hard-and-fast rules. The horizontal retort-settings in certain of the houses at Nottingham are not to-day in the pink of condition; and dealing with a mixture of coal containing 30 per cent. of cannel is perhaps more favourable to carrying-in than to projection. These are considerations not to be lost sight of. There is another matter. In view of recent decisions to partially reintroduce lime purification, it is interesting to note the good character given to oxide purification, under the President's conditions, in regard to coal supply and manufacture. By careful attention to washing

and carbonization, carbonic acid has been reduced to such proportions that oxide purification presents no difficulties, and sulphuretted hydrogen and sulphur compounds have been reduced to a fair average figure. Both blue and carburetted water gas are used at Nottingham; and when sperm value is suppressed, Mr. Brown sees a big future for the blue brand of water gas in the composition of a town's supply. The certificate to his good carbonizing practice, taking into account illuminating value, is that since 1902 the make of gas per ton has increased from 9800 to 11,200 cubic feet. Good work has been done for Nottingham in the Gas Department during the past eight years.

The gas industry is going to have a large future. Its enemies wish they could honestly believe otherwise. The President points to the trend of its development; and, from all the tokens, he hazards the prediction that the next fifteen years' progress will far exceed anything that has taken place since the days of Murdoch. But this development will not proceed unless the gas industry encourages the growth by working for the revocation of hampering legislation, and by seeing that highly trained technicians are provided for the future, and put in supreme control of the undertakings of the industry. The technical problems that are met with do not tend to become fewer, less important, or less tough. Their solution leads to industrial development; the development to fresh problems. And so we proceed. The successors of those in chief control to-day will have to deal with these problems; and therefore the production of the right men is a matter for thorough consideration. The President also claims that now more than ever, in view of the position to which the industry has attained, the Institution and the District Associations should strive to improve the prestige and standing, in the public eyes, of members of the gas profession. In the supply of light, heat, and power, the horizon of the gas industry appears to recede day by day; and the complete conversion of the conditions of use opens up opportunities that were not manifest before. This touches the character of the gas supplied; and we have seen already what are Mr. Brown's views in this direction. We are not at all sure that, in this connection, he is not looking with regretful eye upon the lamentable waste of good gas—double the quantity required for Nottingham—that is going on at coke-ovens to-day within a radius of thirty miles of Nottingham; and this gas he calculates could be delivered into the Nottingham holders at probably not more than two-thirds the present manufacturing cost of gas at the city works. As things go in America, the distance named by Mr. Brown is not great for the conveyance of coke-oven gas. In our issue for Feb. 21, reference was made to the transmission of such gas for lighting a distance of ninety miles. Is this a possible development in connection with the gas supply of Nottingham? If so, Nottingham would indeed be a pioneer in this direction, on the large scale, in this country. It seems almost too much to expect that such a thing is likely to occur in any immediate period; but any way it is fascinating to contemplate it as a distant possibility. Here we must leave an address to the reading and consideration of which the greater the care bestowed, the larger we find the meed of interest.

Science and Industry at Leeds.

The Society of British Gas Industries met last week at Leeds, under the presidency of Professor Arthur Smithells, F.R.S. The University was the scene of the business meeting, and the object of cardinal interest during the two days spent in the great industrial city. Members of the Society were received by the University authorities with a cordiality and friendship that suggested more a home-coming than the reception of strangers within their gates. This cordiality and this friendship are not directly attributable to the establishment at the University of the Chair of Gas Engineering and Fuel as a memorial to the late Sir George Livesey. It has—it could not be otherwise—unquestionably accentuated both in respect of the gas industry; but there has ever been a catholic magnanimity shown by the University authorities in doing a part, within the circumference of their power, to advance, in every possible way, efforts that have for their object the consolidation of the relationship of Science and Industry; and to this every member of the Yorkshire and District Junior Gas Association will heartily subscribe. But the meeting of the Society of British Gas Industries at the Leeds University, and under the presidency of Professor Smithells, did more than anything else could have done to emphasize the pure affinity of Science and Industry by examples that at one time were, and by a few are now, regarded as having polar separation. This is one of the fictions of the past that is being buried deeper day by day. "Science has its roots, and has gained its greatest impulse, "in the practical avocations of mankind," said Professor Smithells in the address, brilliant in phrase and thought, with which he inaugurated his year of office as President of the Society. The gas industry can return the compliment, and with the strongest of reasons; for, without the impulse that Science has given to its industry, its material interests would ere this have suffered a grave depreciation. It is a big debt that stands against the gas industry.

To the address of Professor Smithells we have nothing to add. There is nothing from which we can detach ourselves; and nothing upon which criticism can be passed. It is an address that no one engaged in industry—gas or otherwise—should miss. It incites thought; and that is its one clear object. It presents the materialistic side of the fruits of the application of Science to "the avocations of mankind;" and that is what the man of industry who is yet an unbeliever in anything as essential in culture higher than the most elementary education requires to stir his imagination to the realization of advantage. It passes strange that, with the proofs thickly strewn about us of the material benefits that have accrued to industries and to the world generally from the application of Science, through higher culture, to practical ends, there should still linger doubts as to industrial progress and efficiency having such a large dependence on the scientific-practical man. It was at one time extensively thought that the scientific man could not be practical; there is still a survival, fortunately in a much-lessened degree, of this fiction. But let the men of industry among whom there is this survival ask themselves whether it is possible for the practical man to be scientific; and they will hardly care to admit the impossibility. It is the turning out of such scientific-practical men that the new Universities, like Leeds, have set themselves to accomplish. Many industries acknowledge that they have been extraordinarily successful, and are to-day indispensable to the maintenance of their interests. We saw the fruits of success on all hands in the old-established departments during the visit to Leeds; and there is the opportunity now of making an equal success of the new department that, under Professor Bone, is devoted to the interests of the gas industry, and through which that sure scientific foundation can be laid upon which practice can be built with a certainty.

We recommend all gas engineers who have opportunity to visit the Leeds University, for they will come away impressed with a fact that stands out with marked prominence, and it is that the science taught is brought into such close relation with practice that the student cannot fail to see that the one is but the path to the other—cannot fail to see that the intercommunication between the one and the other is as free as the atmosphere about us. The advantage of a student living for a time in an atmosphere charged with the mutual dependence of science and practice is invaluable. It is an advantage that has been proved great and real; and the University authorities ask (it is their dominating desire in connection with the Livesey Memorial) that the gas industry shall make the fullest use of the opportunities offered. We want to see the Memorial grow as a living thing; and this can best be done by making a large use of it by promoting the attendance of pupils at the classes and in the laboratories. As the President of the Institution of Gas Engineers (Mr. Alexander Wilson) said on Saturday, at the close of the visit to the University, "the success of "the other departments here augurs well for the gas in-"dustry." That can be heartily endorsed. The University authorities, in fulfilment of their part, are ready with all that is necessary to make the educational facilities of the department a big success. But it must be recognized now and in the future that the second part to success rests with the gas industry entirely.

Surface Combustion and Gaseous Heating.

When Professor W. A. Bone first offered for the consideration of the gas industry his theories upon, and the results of his research into, the accelerating influence of the incandescent surfaces of solids upon gaseous combustion, many were naturally sceptical, and, with such benevolence as they could muster, looked upon what he had advanced as a pretty product of the laboratory, with but little in it

that would result in practical benefit. But those who best knew Professor Bone, and had a close intimacy with the great intrinsic value of his past work, felt, from the very outset, that he was not the man to come into the outer world from the seclusion of his laboratory with something as to which he himself had not a large amount of faith. Had the sceptics been at the University of Leeds last Saturday morning, and been privileged to see what the members of the Society of British Gas Industries witnessed, a demonstration, on, true, a small exhibition scale, of a practical application of the result of theory and investigation, they would have left the laboratories, as many of those who were present did, asking themselves: "Are we really "now on the verge of a revolution in gaseous heating?" And from scepticism the mind would have been diverted to possibilities.

Needless to say, this small demonstration of practical application was the cynosure amid all the extensive and interesting equipment of the Fuel and Gas Engineering Department, and of the work in progress, to the company of practical men who were present. Here were two flat pieces of porous fireclay fitted into a casing forming a shallow chamber at the back, into which chamber gas was being delivered at the district pressure of probably 2 inches, and into the gas-supply pipe was being fed air at the modest pressure of $\frac{1}{8}$ inch. The surface of the material was at a pure incandescence, with no visible flame, excepting here and there at the junction of the permeable material with the casing, through the ill-fitting of the two in the small roughly constructed demonstration appliance. The two pieces of porous material were each probably not more than 4 inches square. The consumption of gas was at the rate of about 10 cubic feet per hour; and the air at $\frac{1}{8}$-inch pressure was being supplied at, if anything, slightly in excess of the theoretical amount required for the complete combustion of coal gas. Upon this point, it may be remembered that, in the specifications of the patents of Professor W. A. Bone and Messrs. J. W. Wilson and C. D. M'Court published in the "JOURNAL" for Dec. 6, it was stated that, while theoretically gas requires about five-and-a-half times its own volume of air for complete combustion, the patentees prefer, in order to obtain good results, about seven volumes of air to one of gas.

The effect on the surface of the material of the ignited mixture percolating the specially prepared refractory material was extraordinary. It was beautifully incandescent. Flame we all knew was there; but on the surface of the material itself, the flame was not visible to the naked eye. It all seemed to be absorbed by the material in producing the surface incandescence. It was obvious that here we had as complete combustion of a gaseous mixture as has ever been witnessed in any practical application; and the whole of the flame must, it seemed to the observer, have been engaged in doing useful work. No smell could be detected above the little incandescent slabs. Their incandescence was not of the character that produces a glare irritating to the eyes, any more than purely incandescent fuel in an ordinary coal grate. But there is another peculiarity about the results of the combustion of these innumerable small flames over the surface of the porous material. The incandescence is on the surface of the slabs only; and the backs of the slabs, it was on inquiry learned from Professor Bone, are maintained as dull during use as before ignition of the combustible mixture. In confirmation, one could place the hand at the back of the shallow chamber without the slightest inconvenience; and this shows how small is the loss of heat from any part that is not doing active work. The result is that from the working surface, one gets what may be described as the maximum of effective radiation; and though the slabs were small, the heat that was being radiated from them was so great that, in the large laboratory, one did not require to stand many minutes a yard or so in front of them without feeling a desire to put a greater distance between oneself and the heat source. It will be apparent that—the gas being under district pressure and the air at $\frac{1}{8}$-inch pressure, and knowing what we do as to results in incandescent lighting of the effects of increasing the pressure of the combustible mixture—this invention offers the prospect of a large variation and regulation of the range of temperatures, for industrial purposes, by varying of the pressure of the air and gas.

This brings us to the point of practical application. The necessity for the slight increase of air pressure will present itself, at first blush, as the only obstacle. But this will diminish to vanishing-point on very little consideration. The raising of the pressure of the air by only $\frac{1}{8}$ inch for ordinary purposes, as seen, merely means for a large installation the use of a miniature engine. Development in practical application will, however, follow the line of least resistance; and this will be by taking large-scale application as the initial end, and descend gradually to the scale of domestic application. Where radiated heat, obtained by pure and cleanly means, is required, there is one starting-point; and we may instance the biscuit factory, confectioners' establishments, cooking in hotels, and other large establishments as offering inlets for application. Industry in numerous branches likewise offers a field. Then comes heating in large hotels, public institutions of all kinds, spacious halls and churches, where a small air pressure-raising machine can be installed at inconsiderable cost, and yet provide a large return to the user in heating value. Then the step to domestic heating is not an insuperable one. We know what has been done in the utilization of the heat of incandescent burners for raising the gas or air pressure for producing a high-pressure high-power self-contained lamp. There can be no great mechanical difficulty in employing the heat of a gas-fire to raise the pressure of air to the small extent needed for realizing the effects that were seen in the laboratory at the Leeds University on Saturday. But let it be said at once, to avoid any misconception, that the little display made there on Saturday was only for the interest and information of visitors specially concerned with all work that represents, or is expected to represent, progress for the gas industry. This is work that has nothing whatever to do with the University; and its development is proceeding quite apart from this centre of learning, whose main work is that of producing men of special service to the great industries of the country. But in these pages we bring into the light all invention and all work, produced by the combination of science and practical knowledge, which holds out the prospect of advantage for our particular industry. And here we have a development in which are resident great possibilities, through a branching-out from the direct line of practice into, for gaseous heating, an altogether novel path. The question now is, Will there be any practical obstructions to development? There is much encouragement for the belief that there will not be. Anyway, the gas industry will await, with marked interest, the news of developments and further information as to efficiency.

Developing the Gas-Heating Business.

REMEMBERING that the Society of British Gas Industries were assembled in Leeds, under the scientific palladium of the University of which city the British gas industry has so recently largely placed itself, there was an appropriateness in the paper that Mr. T. G. Marsh read at the meeting last Friday on "The Gas Industry: A Retrospect and a Fore-"cast." But though the author stated that one of the objects of his paper was "to endeavour, from a consideration of the "successes and failures of the past to formulate a forecast "of the trend of future events, and, as far as possible ascer-"tain whether the limit of expansion in the gas industry has "been attained," it is manifest that he set himself a very awkward task, and that we are still without the forecast. We cannot, as a matter of fact, in such an industry as that of gas supply, judge much as to the future from the past; but it is possible to take into account the present position, and, so far as is permissible to human intellect and perception, presage, with more or less reliability, the lines of development in the future. The gas industry of to-day has so changed its organism and its robes that there is little identity in either respect between the past and the present. What Mr. Marsh does is to point to the lines of development (which lines daily become marked more deeply), and to show errors of the past (though he has not taken into account the whole gamut) that stand as obstacles to more rapid progress along the path of development.

We will inspect these obstacles a little closer presently. But there is a word or two more to say about Mr. Marsh's retrospect, because we do not wish one statement in it to go forth without a note being made of a little necessary qualification. The author divides the history of the gas industry into three periods: "The period of inception; the period of "success and monopoly; and the period of stress and com-"petition." We do not want it to be falsely imagined by those who are outside the gas industry that the period of the gas industry's greatest success was the period of monopoly, because that is not true; and in quoting the figures of our

industrial expansion for the past twenty years, Mr. Marsh himself supplies the refutation. The real and the greatest success of the gas industry has been during the era of stress and competition, and only during that period has it entered into occupation of its sphere as the supplier of gas for most domestic and industrial purposes in which heat and power are required. The stoical demeanour of gas administrations and the monopoly of gas live no longer; and to-day there can be traced in business development the keen activities of the ardent workers of the industry throughout the length and the breadth of the land. "Stress and competition" have—if not completely, to a very large extent—removed certain inertia and error, and imparted stimulation, in the administrative sides of the industry; and to that extent there is greater hope than could have obtained before for the materialization of the views as to the future that Mr. Marsh holds with such deep conviction. There are, however, still more administrative inertia and error to be removed; and still more stimulation is required in places.

There is indeed no gainsaying that opportunities have not been taken possession of to the full. A more businesslike and a more generous policy would have carried the industry, our author contends, much further along the road of heat and power business development. In this connection gas administrators and managers have not only to take things as they are, but they have to look to the future. Looking to the future, they have to remember that the competitors are not standing still. Let us repeat those half-a-dozen words, "the competitors are not standing still." The generating costs of electricity are being reduced; tariffs for cooking and heating are in vogue that no one can justify on any ground other than that need in competition annihilates discretion; and electrical appliances improve in general condition and efficiency. We are well ahead in all respects; and we have got to keep ahead. To maintain the position of the industry, to maintain development, and to secure the economies that accompany growth, it is necessary, as Mr. Marsh submits, to take strong possession of the extensive field in heating—the most extensive field—that is open to the gas industry, and the greatest resistance to entry to which is of the gas industry's own making, partly due to the errors of the past, partly due to the worship of the principle of price uniformity, instead of the principle that prices should be anyway in a measure controlled by considerations of competitive values, and partly due to indifference. The views of the author regarding cheap gas for heating are well known; and he condenses them again in this paper on the broad ground that they constitute a wise commercial policy. "What I am suggesting in this paper," he says, "is that lighting gas should retain its old price, and that for the purpose of fires, there should simply be a nominal margin on the absolute cost of the gas. . . . I am satisfied that most towns in the kingdom could [by this means] increase their sale of gas by 33⅓ per cent. in a period of three years." Although Mr. Marsh modestly says nothing about it in his paper, he has solved in one way the old problem raised by differential prices—the expense of duplicate piping and ordinary meters—by the invention of the ingenious little discount meter or indicator.

In some instances there are obstacles to differential prices to the extent necessary to make gas heating popular that can only be effectively removed by parliamentary appreciation of the new circumstances of the gas industry as compared with the old. There is the discount clause in many Special Acts that defines the maximum amount of rebate that can be allowed for large consumption as 15 per cent., though up to an additional 10 per cent. can be granted for prompt payment. But it does not follow that though gas is consumed for heating in the day time, it could be called large in the case of individual consumers, and there is the restriction as to discounts being the same under like circumstances. But Parliament has admitted the drawback to the gas industry of the inflexible fixing of the amount of the discounts allowable, and is, when asked for it, permitting elasticity by merely requiring that whatever discounts are granted they shall be the same under like circumstances. That is better; events having clearly proved that the definition of the limits of the discounts was an error. Then there is another—this an ancient—obstacle found in a number of Gas Companies Acts, dating back to the time when gas was used only for lighting. It is the public lighting clause, which provides that gas shall be supplied for this purpose at a price equal to the lowest charged to any private consumer in the district. There are companies who have succeeded in recent years in getting the words "for lighting purposes" inserted in the clause; and this is just, in view of the use to which gas was put when the clause was originally imposed or agreed to. But there are local authorities who stick tenaciously to their pound of flesh, and who insist that, though the conditions of gas use have changed, the old clause shall be complied with to the very letter. In doing this, they are the enemies of local interests, and not the guardians. For there are no arguments that can be advanced to show that cheaper gas for heating and power is not to the advantage of any community. This brings us to the uneconomical policy (treated of by the author) of local authorities aiding the rates out of gas profits, rather than serving the larger interests of the community by using the money for distributing cheaper gas. The economies through a purer and cleaner air, contributed to by a scientific and cleanly means of heating, are incalculable. But this unlimited profit appropriation in aid of the rates has been so abused that it has at length become a rank growth, which will not be extirpated until Parliament makes a comprehensive move, instead of the slow process of a case by case application of restriction after the manner of the past two sessions.

These are some of the obstacles to the practical consummation of Mr. Marsh's advocacy; and strong sympathizers as we are with his views as to the prosecution of greater effort in the gas-heating field, we have to recognize the obstructions in the path, in the case of some gas undertakings, of taking the differential price course to the extent suggested by him. The errors of the past have to be rectified in order that the present and future may benefit.

The Value of the Fitting Department.

In these competitively stressful times, the importance of the fitting department cannot be over-rated; and therefore too much attention cannot be accorded to it. The responsibility resting upon it is immense. It really stands as the defence against competition; and its influence in the progress and maintenance of the gas business is great. It can do much to make or mar satisfaction. It is likewise an important factor in the financial results of an undertaking; and upon the measure of its efficiency, through the economy that efficiency brings in its train, there can be corresponding reliance that many of the items in the revenue account under the head of "Distribution" have been well and wisely spent. If all this is appreciated and duly weighed, no one will regard time spent upon the consideration of the work and power of the fitting department in any way wasted.

The essentials in the fitting department for consideration are three: Competent men, good organization, and a broad scheme of work. The necessity for these three essentials being at the base of the operations of the department, though not expressed in these words, supplied the foundation of the pithy paper that Mr. W. W. Townsend, of Hereford, read before the Midland Association of Gas Managers last Thursday. His arguments are put forward more by pertinent illustration than by advancing principles. By the former, however, he establishes his case. There is much more that Mr. Townsend says that could be said, upon every point he raises if, instead of in a single paper, the subject were dealt with in a series. Take the point as to the competence of the staff of the department. The author speaks of the multifarious appliances, and the myriad of makers' types, that are now on the market, of more or less merit, for meeting the requirements of the consumers of gas for lighting, through domestic, trade, and industrial uses, to power purposes. To deal with this great range of appliances, means an extended knowledge, and such knowledge demands a liberal specialized education. We were glad to see from the presidential address of Mr. Robert Watson, to the Manchester Institution the previous Saturday, that the Birmingham Master Gas-Fitters' Association are taking up this question of the education of fitters who are engaged in gas work. It is the responsibility that depends upon the work of the fitters, and the demands of the times, that lead Mr. Townsend to the conclusion that the work in consumers' houses, in business premises, and in factories must in time be concentrated in every gas undertaking. There is complete agreement with him by all who prefer to look ahead, and not keep their eyes fixed upon the past. But there will be difficulty in carrying such a necessary change, where a fully-equipped and free-moving fitting department does not already exist, in the case of many municipal authorities with whom private trading interests are influential, and have to

be reckoned with. But there it is; the time must come when the position will enforce the necessity of every municipal gas department having the same liberty as a gas company in this matter of a fitting department. It is not by any means the same thing as the trading in wiring and fittings for which power is sought by municipal electricity undertakings. There is nothing speculative about it; and ratepayers benefit from it. We find a very large area of meaning in the few wise words of the author when, acknowledging that price is an important factor, he says: "I would rather "sell gas at 3s. with the aid of a fitting department, and "with a free hand, than at 2s. without those very necessary "helps in the fight against competition."

The work of the fitting department may be said to be almost infinite. It has not only to deal with proper installation and setting to work of the appliances, but there is the work of maintaining the high efficiency of which every well-devised and well-constructed gas appliance and piece of gas apparatus is capable. It is incidental to the use of gas that efficiency maintenance demands periodical attention; and with periodical attention, things will go quite well. It is not the same with one of its competitors. In its case, however great the attention bestowed upon it, the user is the victim of numerous casualties for which he is unprepared, and which cannot be rectified without the expert hand. The gas consumer may be said to be absolutely free from such occurrences and inconveniences; and it is only the maintenance of the inherent efficiency of every appliance and piece of apparatus that is necessary to sustain his unqualified approval. Mr. Townsend compares the results of the system of maintenance (for example) of incandescent gas-burners of which he had experience in the tropics some nine years ago with what he found on his return to this country. In the far-off place to which he refers, in face of fierce electrical competition, nearly 90 per cent. of the lights in the houses and business premises were incandescent gas, and the whole of the street lamps were on the same system; and the gas suppliers did practically the whole of the maintenance. It would be interesting to know more of the details of the successful scheme. But what was the result? It was that it was difficult to find a broken mantle or a dirty burner in the place. The contrast with our home conditions is not in our favour. But what gas men have done, and in such a distant clime, that surely gas men at home can do. The author argues for complete maintenance by gas authorities.

We badly want complete detachment from the notion of being merely gas suppliers, and get the idea well embedded of light, heat, and power suppliers. This idea will help to force open the sides of a circumscribed gas policy where it exists, and help to expand ideas and methods, and to create new ideals. There is a great deal of work to be done, for the protection of the excellent foundation and superstructure that the gas industry possesses, and the fitting department serves as the avenue through which much of this work can be accomplished. Just think of it, that now, in a place with the conditions of Hereford, the day consumption is equal to 50 per cent. of the total sales in the winter months, and to 52 per cent. in the summer months! The curves which Mr. Townsend presents to us in this connection are interesting. So also are the suggestions that he makes as to the work of the fitting department; and not the least the one where he submits that for freedom of examination, for making connections, and for protection, internal piping should be run and cased after the manner of electric wiring. This is a good suggestion for such places as shops, halls, factories, and for some of the rooms in a house; but we can hardly fancy having the walls of a delicately decorated drawing-room, or of a dining-room disfigured and cut up in this way. If not exhaustively argued, the matter and suggestion of Mr. Townsend's paper are valuable.

For our Country.

Some kind, but well-deserved, remarks as to what has been done by the Gaslight and Coke Company, were made by the Right Hon. R. B. Haldane, M.P., the Secretary of State for War, when he visited the Beckton works on Saturday for the purpose of inspecting those of the Company's employees who have joined the territorials, and of formally opening a new miniature rifle range. The occasion was an interesting one; and not the least pleasing feature of the visit was the excellent account which was given to Mr. Haldane of the accomplishments of the Rifle Club. In the course of a short address to the men (which will be found noticed in another column), the Minister truly remarked that Mr. Corbet Woodall and his colleagues on the Board have furnished proof of the possibility of a great nation like ours, engaged in large industries, combining with them, just as a natural part of the national life, its military organization. Other companies and firms have, of course, done good work in the same direction; but the example is a good one which might with advantage be still more widely followed than has so far been the case. The gas industry, strong in attack and defence as regards its business side, will, we feel sure, be no less so in a physical sense, should, unhappily, a time of trial arrive.

Hints on Gas Fires.

It was an excellent idea that a lecture on "Gas-Fires and their Fixing" should be given to the London and Suburban Ironmongers' Association; and it was also an excellent thing that someone with many years' practical experience of the things of which he spoke should be selected as the lecturer. Mr. H. H. Creasey, of the Gaslight and Coke Company, was able to give his audience many practical hints of just the kind that were most likely to be of use to them; and the attention with which his remarks were received showed that his time was not being wasted. To some extent, of course, Mr. Creasey covered the points that were referred to in the paper Mr. E. W. Browning lately read before the London and Southern District Junior Gas Association; and both may be complimented on having taken so much trouble to enable others to benefit by the experience they have gained through long years of hard work and careful study of the problems of gas-fires and their fixing. As already remarked, there is no doubt the ironmongers will benefit from what Mr. Creasey had to tell them; while as for Mr. Browning's paper, we know that this has been studied by a far wider circle of readers than the Association to which it was primarily addressed.

The annual general meeting of the Scottish Junior Gas Association—Western District—will be held in Glasgow on the evening of Saturday next. In addition to the formal business, a paper on "Coal: Its Formation and Variations" is to be read by Mr. John Gillespie, of Glasgow, and discussed.

The death is announced, in his 59th year, of Professor, Van 't Hoff, of the University of Berlin. He was the founder, with the French chemist Lebel, of the science of stereo-chemistry; and he was the Editor, in conjunction with Herr Wilhelm Oswald, of the "Zeitschrift für Physikalische Chemie"—a technical periodical, which collects work done in the province of physical chemistry, and is widely read. He was the recipient of a large number of orders and distinctions in the course of his career. In 1901, he was awarded the Nobel Prize for Chemistry.

At the Wesleyan Chapel, Church Fenton, last Wednesday, the marriage was solemnized of Miss Cissie Blakeley, eldest daughter of Mr. J. Firth Blakeley, and Mr. William Beaumont Sharp, the eldest son of Mr. S. Sharp, J.P., of Morley. At the close of the ceremony, breakfast was served in the school to about seventy guests; and this was followed by a reception at "Beechwood," Church Fenton, the residence of the bride's parents. Later in the day, Mr. and Mrs. Sharp, who were the recipients of many handsome presents, left for Llandudno.

At the Birmingham University on Feb. 23, Dr. Percy F. Frankland, F.R.S., gave a lecture to the members of the Midland Section of the Society of Chemical Industry on the "Bacteriology of Water." He said the all-important questions the examiner had to answer were the same to-day as they had been all along—viz., had the water been contaminated with the excreta of man; and, if such contamination had taken place, had the water in its subsequent history been subjected to conditions which would ensure the destruction or removal of the pathogenic bacteria which might at any time be present in such human refuse. To the first question bacteriology could not give a categorical answer even to-day; but to the second, a qualified one could be readily given. One of the most important advances made in bacteriology during recent years was the careful characterization of bacteria by means of bio-chemical tests, and the isolation of particular types of bacteria from such mixtures as were present in water by means of special culture media. However, until bacteriologists had agreed upon uniform tests for each particular microbe, it was unavoidable that there should be much confusion, and that the results obtained by different observers should be difficult to compare. While the outstanding achievement in bacteriological water examination during the past fifteen years was the systematization of tests for detecting the presence of specific bacteria, the various possible sources of these bacteria, and their different hygienic significance according to source, rendered any hard-and-fast application of standards based on the presence of these microbes, impossible without liability to serious errors of judgment being committed. In conclusion, Professor Frankland insisted upon the chemical examination and the bacteriological examination of water supplementing each other.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 724.)

THE Stock Exchange has had a bright and active week. The increased volume of business imparted cheerfulness, and the solid advance of prices in some of the most important departments was quite gratifying. Most prominently conspicuous were Consols, which had so long been afflicted with a sort of dry rot. On Friday, they were done at 81⅜, which is equivalent to 82 *cum div.* —a price long unknown. Other gilt-edged securities moved up with them; the chief factor being the monetary outlook. The improvement set in from the opening day, when various strong points converged to start the rise. Home Government issues were strong in demand, and Consols rose ⅜ and ⅜. Most other markets were firm, except the American; while something like a boom was achieved in Rubber. Tuesday was noticeable for the beginning of a recovery in Corporation stocks—the last to feel the rise. Consols rose another ⅛, and a full ½ for special dates; but Rails were a little tamer. Beer showed a good lead. Wednesday was strong and active almost everywhere. The three quotations of Consols rose ¼ and ⅛ and ¼. Rails had a better innings; and Americans were firmer. But Rubber wobbled. Thursday was equally bright. Consols advanced another $\frac{5}{16}$, and Rails were full of rise; but Americans went to pieces, and some speculative lines were flat. Business became quieter on Friday, and there was some amount of realizing. But Consols rose ⅛, and Rails were firm. On Saturday, markets were resting; but the tone was fairly good, though the prices were a bit loosened by profit-taking. In the Money Market, there was a steady demand for short loans, and rates held firm. Discount quotations, however, fell away steadily. Business in the Gas Market showed an increase in point of volume. Some issues were unusually active; and all exhibited steadily increasing strength. In Gaslight and Coke, the ordinary was largely dealt in at rather higher figures, ranging from 105¾ to 106¼—a rise of ¼. The secured issues were active; the maximum marking 85¾ and 86¼, the preference from 101¼ to 102⅜, and the debenture from 79¾ to 80¾. South Metropolitan was quiet and unchanged at 119½ to 120; and the debenture realized 80½ and 80⅝. In Commercials, the 4 per cent. changed hands at 111½, and the 3½ per cent. at 107½. The Suburban and Provincial group showed more life. Brentford old was marked at 253, ditto new at 197½ and 198½, Brighton original at 222, British at 44⅞ and 45½, and Tottenham "B" at 116 and 117. On the local Exchanges, Liverpool "A" was done at 216, ditto "B" at 162½, Sheffield "A" and "B" at 236 (a rise of 1), and ditto "C" at 236 and 236½—a rise of 2. In the Continental companies, Imperial advanced 1½, with transactions ranging from 186½ to 189, Union was done at from 96 to 96¾, and European fully-paid at 26¼. Among the undertakings of the remoter world, Monte Video changed hands at 13⅛, Oriental at 140 free, Primitiva at from 7¾ to 7⅞, ditto preference at from $5\frac{7}{16}$ to 5⅝, ditto debenture at 97 and 97⅛ (a rise of 1), San Paulo at 16, and ditto preference at $12\frac{1}{16}$.

ELECTRICITY SUPPLY MEMORANDA.

A Principle and Its Abuse—The Boycott—Gas Exhausting the Air Supply—An "Innocuous" Commodity an "Insidious Poison!"—Lamp Prices and Fragility—Cooking and Distribution—Shop Lighting.

THE discussion of points in dispute between the Gas Committee and the Electricity Committee of the Manchester Corporation has brought from the latter Committee a reply to the charges made by Alderman Gibson, the veteran Chairman of the Gas Committee, as to the unfair commercial practices in which his Committee's competitors indulge, to the detriment of both the Gas Department and the ratepayers' interests. The reply is a categorical denial of the charges, unsupported by anything material on some most essential points. In the main, the matters in dispute, where they do not touch principles, have a greater local than general interest; but where they do touch principles, then information is withheld that entirely disenables one from seeing whether or not the principles are abused. There is the question as to the charges to power, heating, and cooking consumers, which charges shoot, especially in regard to power, to, we suspect, such a fine point per unit that they would disappear entirely if carried any farther. There are good grounds for so suspecting, for the Electricity Committee absolutely decline to divulge the prices that are charged to individual power users. And why? "Because the cost of supply in any particular case depends upon so many factors"—in fact, so much "ignorance prevails regarding this subject that it would be injurious to publish the prices without stating fully the conditions obtaining in each case, a course which is impracticable." Weak, very weak! The delicacy of the Committee's situation no doubt is best exemplified by the delicacy of the prices at present being charged in certain cases.

The Committee do us the honour of quoting in their report an extract from the "JOURNAL" as to the applicability of the principle of charges depending upon the nature of the load. One of our electrical contemporaries says that we have admitted the "*perfect* justice of such variations in the tariff." That is a stretch of the imagination. Nothing of the kind has been admitted. Nowhere in our columns will it be found that the justice of the extraordinary variations in prices in vogue among electricity undertakings is any fair recognition of the principle. If the principle were fairly recognized, the charges for many power supplies, and for domestic uses other than lighting, would not obtain. The Electricity Committee, in detaching a sentence or two from previous comments in the "JOURNAL," cannot have read the whole argument. If they had, they would hardly have given the bare quotation, if animated by an honourable spirit. The matter was dealt with in our "Electricity Supply Memoranda" on Oct. 4 last, and when commenting on a letter by the Corporation Electrical Engineer (Mr. G. L. Pearce) in our issue for Oct. 18. It will be seen by reference to these criticisms that Mr. Pearce judiciously declined to enter into argument on various points, or to supply information for which we asked him. In the comment on Oct. 18, the remark was made: "Principles may be sound enough and acceptable; but their abuse and want of uniform application is another matter. It is the abuse and want of application in the case of electricity supply that cause complaint." We have not seen the full report of the Electricity Committee; but it does not appear from the published abstracts that a fair representation has been made by them of our points.

Another subject upon which criticism was recently passed in our columns [*ante*, p. 507] was as to the unfair stipulation that, in entering into an arrangement for the supply of electricity to certain blocks of dwellings, no other form of illumination should be used in them. In treating of this, we not only animadverted upon the unfairness, but questioned the right on the part of the Electricity Committee to deprive the tenants of the liberty to bestow their patronage where they pleased, inasmuch as Parliament has made it compulsory on the part of both gas and electricity suppliers to give a supply on certain conditions, one of which is not that the rival commodity shall not be used. Such a condition, too, puts an end to all competition where it is applied. But it seems that, in the case of the blocks of dwellings in question, the arrangement has been stopped. But the Committee now deny that, in the case of one estate, the letter written debarred the use of gas in any of the houses for lighting purposes. Was there any understanding, apart from a letter? The Committee justify the supplying of the landlord with electricity in bulk for the supply of the houses at a lower price than to ordinary lighting consumers on the ground that they would be relieved of the responsibility of collection, payment, &c. But "they had no intention to boycott gas, or to enable the landlord to make a profit on resale." But surely the Committee could not seriously think that the landlord would go to all this trouble in connection with his part of the arrangement unless there was something in the nature of profit hanging to it; otherwise the tenants would be obtaining their electricity at a price below that of other ordinary lighting consumers. On more grounds than one we think there would be some process available for stopping such an arrangement. If, however, this sort of thing can be done, what is there to prevent one of the power users with current supplied at a microscopic price running a wire through the party walls, and serving his neighbour at a slightly higher figure. But while the Committee emphasize and re-emphasize that they have no intention to boycott gas, they are afraid that instances might be quoted against them that look suspiciously like boycotting. They admit that in some other cases where considerable expenditure has been incurred on mains, and a monetary guarantee could not be obtained, the Committee have felt it necessary to ensure the return on their capital by asking that electricity should be used exclusively, or in the main, for illuminating purposes. They do not call this boycotting. We do. It is condition boycotting gas rendered necessary to cover speculation. Alderman Gibson was not far wrong; and the Electricity Committee in this connection have a very bad case.

If there is anybody in this great Metropolis of ours who is unable to breathe, please put it down to gas. It will be all right, for there is the authority of Percy Good for saying it. We do not know who Percy Good is, nor anything as to his credentials for posing as an authority on the subject. But that matters little; he has said it, or something to the same effect, in a published article. To say the least, it is a very silly article, though it deals with prodigious figures. He makes out that gas has such an enormous appetite for air that it is wonderful there is any air left in, over, or about London—in fact, through that enormous appetite, gas is practically a murderer. "It must be remembered that gas burns near the people's mouths . . . and 15,000 [in London] go out every year for want of air." "Go out" is Percy's expression for dying. This being so, and as Percy Good believes that the gas companies pay almost, if not quite, the whole of their dividend out of bye-products, then, if bye-products must be made, let "the public purse be used to shift the gas companies nearer to the sea coast, and let them make their bye-products, but insist on the suppression of the sale, as an 'innocuous commodity, of this insidious poison.'" Is the learned Percy at fault, or the joint editors of the paper in which this stupid effusion is published? How can an "innocuous" commodity be an "insidious poison?" Then the writer goes on to suggest that gas should be supplied in bottles and labelled "poison." "Other poisons," he says, "have to be supplied in specially shaped bottles, or at all events properly labelled. Why not this stuff?" Percy Good might be careful, and not lose his head, so far as to forget that courtesy is not a bad quality in one who presumes to instruct his fellow men. Perhaps, before going farther, we ought to explain that this article

does not appear in any of the comic weeklies, but in our grave and revered contemporary the "Electrical Review."

There is another paragraph in the article that is interesting:

The amount of gas made in London in one year amounts to a total of about 50,000,000,000 cubic feet—a truly colossal amount. Every one of these requires over 8 cubic feet of air for its combustion. The air required is, therefore, about 450,000,000,000 cubic feet—over three times as much as the whole of the people want.

We will not here discuss the ignorance as to the amount of air an individual wants. At the moment, we feel we need a lot with Percy's article before us. But it may be pointed out that the amount of gas made by the three London Gas Companies last year is about 6,000,000,000 less than Percy Good quotes. It may also be mentioned that a cubic foot of gas theoretically requires an average of about 5 cubic feet of air for its complete combustion—not 8 cubic feet. An upright incandescent gas-burner in its mixing-tube requires about three volumes of air to one of gas; an inverted burner about two volumes to one of gas. So that, taking between 4 and 5 cubic feet of air per cubic foot of gas, the air required for the combustion of the gas made in London—spread over probably 160 square miles, 365 days, and about 4000 miles of streets—is not 450,000 million cubic feet, or anything like it. Now we may give Percy one or two more calculations, as he likes them. Will he find out how many pounds of coal are used at all the electricity generating stations in London; and, as a pound of coal requires 240 cubic feet of air for its complete combustion, will he tell us how much air is required for the combustion of the coal used in generating the electricity required in the Metropolis? Then will he extend his investigation to the coal used in the dwellings and factories of our great Metropolis? If he does all this, perhaps gas will be found to be a comparatively little sinner, in the matter of air appropriation. It may be repeated that Percy Good's article appeared in the "Electrical Review." The fact ought not to be lost sight of, as we should not like the credit to be wrongly attached to any other electrical paper.

The metallic filament lamp is still a source of trouble of various kinds. We are not referring on this occasion to the reducing power of the lamps on the output for lighting of central supply stations. It is a recrudescence of price-cutting that is just now causing the wearied to feel more wearied still. Some time ago there was a break in prices; and then came a sort of understanding between the makers, which understanding is now said to be in a state of unstable equilibrium. It is not competition that is doing this, so much as the fact that there are now so many makers and many named (we will not say types of) lamps, that there is not enough business doing to go round properly. Naturally every firm wants to be on top in the matter of business done and profit made, though we are assured that "the profit on the sale of a wire lamp is so small that, unless a large turnover is effected, it is not worth the trouble." One maker is now quoting 16 to 20 candle power lamps (100-135 volts) at 2s. 6d., as against 2s. 9d., while the high voltage patterns in 25 to 37 candle power are now offered at 3s. 9d., as compared with 4s., and the 50-candle power type at 3s. 6d., instead of 3s. 9d. There is a feeling that this means the beginning of fresh price-cutting, and that there may be an attempt to make the contractors suffer through the discounts. If this is so, it is pointed out by the "Electrical Times" that it will further discourage the contractors. Then is stated, what all who have anything to do with the metallic form of lamp are only too painfully aware of, that "the percentage of breakages, faulty lamps, and accidents is still large, and the makers will not replace any but those which obviously have failed prematurely, or have broken in transit." The fragility of these lamps is having broadening recognition. Mr. Leonard Murphy, of the East London College, writing to the "Electrician" to point out where he thinks betterment may be effected at one source of disaster to this form of lamp, says: "It must be admitted that its extreme fragility, coupled with its high first cost, cause many to regard investment in the new type of lamp as a risky speculation. This is especially the case where the price of energy is low, or, again, where the lamp is likely to be subject to even slight vibration."

Mr. John B. Morgan, of Horsham, is a sensible man on the question of cultivating a cooking load. For electricity in some towns, in his opinion (as stated in a letter to the "Electrical Review"), it is not the gold producer, at the prices advocated per unit, that some people seem to think. Mr. Morgan finds that the cost of the distributing mains to carry the day load is in nearly all cases overlooked. It must be remembered that the hours of cooking are comparatively short; and he doubts whether, if a good business were cultivated, the electric lighting mains now in existence in many of the smaller and moderate sized towns would be equal to carrying the load. We do not think there need be any present fear on that score; but Mr. Morgan is contemplating the matter with plenty of "ifs" spread about it. He comes to the crucial consideration, would it pay to lay down heavy copper to carry the cooking load when the maximum price one could charge would be 1d. per unit? Apparently he thinks not. A little consideration also shows that, "if electric cooking at its present current consumption reached the height of popularity that gas cooking enjoys, the day load from 11 a.m. to 1 p.m. would far exceed the evening lighting load, and plant would have to be installed to meet this short demand in order to sell current at a cheap rate." For his conditions Mr. Morgan is evidently sceptical as to the financial advantage of a cooking load at a low price; and there is no doubt he is right.

There is little question about it, the Lighting Committee of the Islington Borough Council are seriously concerned as to the success of high-pressure gas-lamps in displacing electric lamps for shop-front lighting. It was remitted to them a short time since to consider what should be done to stem the flowing tide, and to safeguard the interests of the ratepayers, whatever that may mean in this connection. One of the interests of the shopkeepers is economy, and another is a good, suitable, and reliable light. To obtain all these through one channel must be to the interests of themselves and their customers, and both shopkeepers and customers are ratepayers. Thus the conversion to high-pressure gas lighting is in the interests of the ratepayers; and by it those interests are safeguarded. What more do the Lighting Committee require? One thing is that the Council should adopt the portion of the Committee's report submitted on Dec. 16 last, which deals with contract lighting. When this was brought forward at a recent Council meeting, the report was "received without comment." There is something rather funereal about that.

HEER VAN ROSSUM DU CHATTEL.

Commemoration at Amsterdam of his Twenty-Five Years' Work as a Gas Engineer.

A SPECIAL number of our Dutch contemporary, "Het Gas," is being issued in celebration of the twenty-fifth anniversary (or "Silver Jubilee" as it is called) of the first appointment of Heer van Rossum du Chattel, the distinguished Engineer and Manager of the Amsterdam Corporation gas undertaking, as manager of a gas-works.

The chief events in his technical career are traced in this number, which also contains a full-page likeness of him. He was born on Oct. 20, 1858, at Leyden, and studied at the Polytechnic School at Delft. He graduated as a civil engineer in 1881, and shortly afterwards entered the Leyden Gas-Works, where he had the advantage of the friendship and guidance of the late Heer D. van der Horst. On March 15, 1886, he was appointed Manager of the Venlo Gas-Works; but in June, 1888, he left to take up the managership of the gas-works at Cadiz. In 1898, however, he gave up this position to become Assistant-Manager of the Amsterdam Gas-Works, of which Heer van der Horst was then Manager. On Oct. 1, 1907, after the death of the latter, he was appointed Manager in his stead.

After referring to his connection with the Dutch Association of Gas Engineers, of which he was President in the years 1906 and 1910, and to his interest in its library, and in the journal "Het Gas," the article calls attention to the fine social qualities which have endeared him to his colleagues abroad as well as in Holland. His marvellous linguistic attainments have stood him in good stead in this direction; and English gas engineers will recall the paper which he read at the International Engineering Congress at Glasgow in 1901, descriptive of the gasholder of 3½ million cubic feet capacity at the Amsterdam West Gas-Works. He also took a very active part in the proceedings of the Second International Photometric Congress, which was held at Zürich in 1903.

We join heartily with our Dutch contemporary in its congratulations to Heer van Rossum du Chattel, and in hoping that he may long be spared to retain the highest position accessible to members of the gas industry in Holland.

Mill Lighting by High-Pressure and Ordinary Incandescents.

In forwarding the accompanying figures giving a comparison of high-pressure and ordinary incandescent gas lighting at Messrs. Stott and Smith's Empire Mill, Congleton, Mr. T. G. Marsh says he is informed that under the high-pressure system the illumination of the mill is perfect, while with the ordinary incandescent gas lighting there was much to be desired.

Quarter ending Dec. 31, 1910.

	Ordinary Incandescent Lights.		High-Pressure Lights.
Number of lights	172	..	140
Gas consumed	135,800 c.ft.	..	52,100 c.ft.
Cost of gas	£16 19s. 6d.	..	£6 10s. 3d.
Cost per burner per quarter	1s. 11·68d.	..	11·16d.

Reinforced Concrete in Retort-House Construction.

At the Guildford Gas-Works an interesting example of reinforced concrete has been carried out in the new retort-house. The floor surrounding the retorts has been constructed on the "lock-woven mesh" system; the work being carried out by the Company's men in accordance with the method prescribed by the patentees, Messrs. J. H. Tozer and Son, of Westminster. The building is 106 ft. 9 in. long, divided up into bays averaging 9 ft. 6 in. span. The feature of the floor construction is the absolute continuity of the reinforcement. The "lock-woven mesh" was supplied in rolls 108 ft. 6 in. in length, and unrolled side by side on the centring from one end of the building to the other—there being no joint or overlap of any kind in the whole length of the structure. Great strength is thus obtained by the absolute continuity of reinforcement, and, therefore, jointless floor. The whole of the work was carried out under the supervision of Mr. P. C. Cleasby, the Gas Company's Engineer, who has expressed his entire satisfaction with the system.

THE TRUTH ABOUT CHELSEA.

THERE has been a good deal of complaint, accompanied by, in the daily and electrical press, much wild talk and misrepresentation, concerning what is called the unfair treatment of the Chelsea Electricity Supply Company in the matter of the new street lighting contract into which the Chelsea Borough Council have entered (the electrical partizans say, with a blind eye to the ratepayers' interests) with the Gaslight and Coke Company. We were disinclined to accept the allegations without careful examination into them; and having made such an examination, we are in a position to say that there is not a shadow of truth in them—whether from the points of view of unfair treatment, avoidance of publicity, or any wilful disregard of the interests of the ratepayers from the financial standpoint, or the value in illuminating efficiency. The attempt to stimulate public resentment on vague assertion and indefinite detail is not honourable, and cannot be to the ultimate benefit of anyone, least of all those who may be the prime movers. It is as clear as anything can be that not one of the component parts of the indictment of the Borough Council can be substantiated.

In dealing with the matter, it is necessary to trace its development from the initial stage in order to show the groundlessness of the charges. The question of a new contract originated with the acceptance, and carrying into effect, of the new contract with the Gaslight Company for the lighting of a considerable part of the City of Westminster, which borders on to the area over which the Chelsea Borough Council have jurisdiction. The considerably improved lighting of Westminster rendered almost imperative something being done to modernize, and thus to improve, at any rate the portions of the Chelsea district abutting on to the Westminster area. The Gas Company were approached with the view of doing this. The matter was considered by them; and eventually they submitted an offer for the improved lighting of the whole borough. It should be mentioned here that the Chelsea Electricity Company have no power to lay cables in a considerable part of the borough of Chelsea, where it adjoins Westminster. The Gas Company's existing contract had about two-and-a-quarter years to run; and their suggestion to the Borough Council was to remodel the whole of the lighting of the area, provided a new contract was entered into. Meantime, the Chelsea Electricity Company heard of the offer of the Gas Company, which at that time had not been before the Council, but was still under the consideration of the Works' Committee.

Now affecting the point as to the knowledge of the Chelsea Electricity Supply Company of what was transpiring, it would be instructive to learn whether Major W. F. Woods, who is described in the local newspapers as the Chairman of the Works Committee of the Borough Council, is the same Major W. F. Woods who is described in Garcke's "Electrical Manual" as a Director of the Chelsea Electricity Company. If so, then, while the irritation of the latter is the better comprehended, it somewhat relieves the insinuation that the Electricity Company were in the dark concerning the matter. However, the Electricity Company approached the Borough Surveyor in reference to the matter; and, naturally acting only within the limits of his power, he informed the Company that any offer they desired to submit must be forwarded in time to be printed on the Committee's *agenda*, in order that it might go through in regular manner. The Company expressed their inability to do this; and therefore, upon representation being made to them, the Committee allowed the Company a further fourteen days. It may be imagined that the Company by the time they were prepared to make their offer knew something as to the nature of the terms of the Gas Company. But whether that be so or not, some statements published as to the length of time the Company were allowed in which to submit an offer are not in accordance with truth. As a matter of fact, we have been able to ascertain that the Company's original letter on the subject was received before Nov. 17; and by the Committee's decision, they were granted up to Dec. 14—a period of upwards of three weeks—for submitting a tender. This statement, therefore, disposes of two of the charges—of any deliberate action on the part of the Borough Council that gave preferential treatment to the Gas Company in the matter of a new contract for the lighting of the whole of the borough, and of any squeezing of the Electricity Company into a tight corner in respect of making an offer for carrying out the lighting, which they were unable to do in the whole borough in view of their powers only applying to a part.

There has been much talk as to the new contract penalizing the ratepayers in comparison with the Electricity Company's offer. What this means, on the transparent facts before us, we are unable to divine. The position is plain; the facts are simple. It must be remembered that the Gas Company's contract had rather more than two years to run; and had the old contract continued, the old prices would have had to be paid for that period. Thus it comes about that, by accepting the Gas Company's tender for seven years, including the unexpired portion of the old contract, the Borough Council will spend £1900 less during the septennial period than they would had they accepted the Electricity Company's offer for a five years' contract. Where are the ratepayers penalized there? Then under the new contract, with inverted gas-burners, the Council have secured 85 per cent. more light than was being obtained under the old contract, or than would have been obtained under the Electricity Company's offer. As a matter of fact, the latter were proposing, if anything, rather less light than was being realized under the late gas contract. It appears that the aggregate illuminating power under the latter was 137,000 candles; the Electricity Company did not offer quite so much as that; while under the new contract, the total illuminating power is 255,000 candles, or 85 per cent. more than formerly. Moreover (we gather from remarks made by a member of the Council—Mr. Cook—at a recent meeting), the Electricity Company proposed to convert the old lanterns for their proffered electric lamps; while the Gas Company's scheme provided for new type lanterns, which, apart from their better construction for light distribution, are an immense improvement to the streets. Again we ask, how are the ratepayers being penalized by the action of the Borough Council in entering into what is unquestionably a wise and businesslike contract?

It is idle and ridiculous, in face of these facts, to talk about the interests of the ratepayers having been shunted into the background, and of the whole business having been carried through in the dark. The manner in which certain daily and electrical papers have been writing on this matter would lead one to suppose that there was some secret motive underlying the action of the Council. It is, however, clear they have done what was the right and best thing in the interests of the borough; and had they done otherwise, then they would have fully deserved the obloquy and censure that have been so freely and undeservedly cast upon them.

A TERRITORIAL INSPECTION.

The Secretary of State for War at Beckton.

THE huge works at Beckton of the Gaslight and Coke Company were *en fête* last Saturday morning, when the Right Hon. R. B. Haldane, M.P., the Secretary of State for War, inspected the "B," "D," and "G" companies of the twelfth battalion of the County of London Regiment ("The Rangers"), and formally opened a new miniature rifle range—afterwards taking lunch on the works. In his inspection, Mr. Haldane was accompanied by the Governor of the Company (Colonel Corbet Woodall), Colonel H. S. Coldicott (who commands the regiment), and Major T. Wilton. Those also present included Mr. U. J. Burke, Mr. John Miles, Sir Hugh Owen, G.C.B., Mr. J. D. Walker, K.C., and Mr. H. J. Waterlow (Directors), Sir John Bethell, M.P., the Bishop of Barking, Colonel Oughterson, the General Manager (Mr. D. Milne Watson), the Secretary (Mr. Henry Rayner), the Chief Engineer (Mr. Thos. Goulden), the Resident Engineer at Beckton (Mr. J. N. Reeson), and the Engineer of the Nine Elms Station (Mr. T. S. Lacey), from which works part of the territorials were drawn. It was quite a practical inspection that Mr. Haldane made of the men on parade—who numbered some hundreds, and included the St. John Ambulance detachment of the works; and this rendered the more gratifying the fact of his pleasure at the appearance of the men, with their guard of honour and excellently trained band. Everything connected with the visit went off in first-rate style; and it is safe to say that the occasion will long continue to be looked back upon with pleasure by all those who took part in the proceedings. After the inspection, a move was made to the Rifle Club buildings, where, first of all, the attention of the Secretary for War was drawn to a very fine display of coal-tar products; and then the miniature rifle range (with distances of 25, 50, and 100 yards) was formally opened by Mr. Haldane firing a shot—which he did after hearing an interesting statement with regard to the club.

Mr. REESON said the club, which was formed in December, 1906, owed its foundation to the President (the Governor of the Company), whose great interest in its welfare had been the means of placing the club in the forefront of rifle clubs. In the first year, the club confined its shooting principally to friendly matches and club competitions; and only one public competition was entered for—that organized by the "Daily Express." In this competition, Beckton was pitted against the best teams in the country, and was successful in obtaining second place with an average score of 772 out of a possible 800, against 778 of the winners (Alexandra Palace). This was an excellent achievement, when it was considered that the majority of the members had not handled a rifle before the club's formation. During the year 1908, the open competitions entered for were the Queen's Cup, National Low Power Championship, Stevens Vase, "Express" Cup, "Daily Telegraph" Cup, National Service League Trophy (Essex Branch), and the Metropolitan Industrial Rifle Association Leagues. Out of the foregoing, the club teams were successful in winning the "Express" Cup, the "Daily Telegraph" Cup, the National Service League (Essex) Cup, and the "A" League of the Metropolitan Industrial Rifle Association. In the year 1909, the club retained possession of the "Express" Cup, with an average score of 797 out of a possible 800 for ten matches fired. This was believed to constitute a record for a team of eight men. Two teams were entered in the Metropolitan Industrial Rifle Association Leagues, both of which secured the shields for their respective Leagues; and after an excellent contest with the holders (Metrogas), Beckton "B" won the Association Cup. The Greville Cup for the team championship of Essex was won at Colchester. The club's representative in the Queen's Cup succeeded in reaching the final stage or "Queen's Twenty;" and after a very exciting contest at the Ham and Petersham range, he was beaten by a representative from the Midland Railway Rifle Club, Derby. In the year 1910, the club regained possession of the "Daily Telegraph" Cup; and at the Essex County Rifle Association's (Miniature Section) first rifle meeting, held at Beckton on Oct. 8, Beckton were again successful in winning the Greville Cup. At this meeting, the individual championship of Essex was won by a member of the club with a score

of 295 out of a possible 300. In the Browne-Martin Competition, Beckton tied with Southfields for first place, and in the shoot-off at the Alexandra Palace Rifle Range were defeated by 7 points. For the third year in succession, the club reached the final stage for the National Low Power Championship, which was fired at Bisley during the annual meeting of the National Rifle Association, and were placed third. The Metropolitan Industrial Rifle Association Challenge Cup was won for the second and third times in April and September last. Three representatives from the club qualified for inclusion in the team of six to represent the County of Essex in the competition for the Queen's Cup. In the Stevens Vase Competition, Beckton "A" team were placed fifth, with an aggregate score of 2360, against 2387 of the winners. A team was again entered for the Astor County Cup, which was fired at Colchester at the Essex County Rifle Association meeting; the ranges being 200, 500, and 600 yards. The contest was won by Southend, after a tie with Epping—Beckton being placed third. This was the only full-range competition entered for; and the club might be congratulated on running the two first-named clubs, who were full-range teams, so close. The membership of the club was 400; and about 130,000 rounds of ammunition were fired each year. In 1909, the London rifle meeting of the Society of Miniature Rifle Clubs was held at these ranges, and extended over three days. Several other meetings, organized by various associations, had also been held there. Two members had succeeded in obtaining the highest possible score at 100 yards, 13 at 50 yards, and 26 at 25 yards. A representative from the club had been selected on two occasions to fire in international matches; and in the last match, *versus* America and Australia, he made a score of 497 out of a possible 500. On two occasions the "A" team, composed of eight men, had obtained the highest possible score (800) in matches.

In an adjoining hall, the men had meanwhile been assembled; and here Mr. Haldane addressed a few remarks to them.

The Governor said he had the very pleasant duty, which he regarded also as a great honour, of introducing to them His Majesty's Minister for War. They knew Mr. Haldane there chiefly because of the work he had done in connection with the great scheme with reference to a territorial force, of which some of them were proud to be units; but the work of the department over which he presided was a very much broader thing than was to be measured by the territorial army. The British army might not be very large; but it had varied duties to perform, and it was scattered all over the world. However, with all the duties that were weighing upon him, their guest had yet been able to find time to visit them at Beckton and make their acquaintance. He ventured to think that this ability to give attention to detail might account for a great deal of the success which had attended Mr. Haldane's administration at the War Office. In the names of his colleagues, of the Territorial Companies, of the Rifle Club, and himself, he gave Mr. Haldane a cordial welcome, and gratefully acknowledged his kindness in coming to see them.

The Right Hon. R. B. Haldane remarked that it had been no task for him to come to Beckton, but a genuine pleasure; and he would tell them why. Before he entered the hall, he was looking at a number of things that possessed for him intense interest—not all of them military things. He was looking at the wonderful products from coal tar, which marked the advance of modern science and the high standard of excellence to which the organization of this great industrial concern had been carried. He was also looking at the splendid miniature rifle range—the best, he thought, he had ever seen—where he had had the privilege of firing a shot. Then he saw the companies and sections of companies, and the St. John Ambulance detachment. He felt that here was what he believed in—the possibility of a great nation like theirs, engaged in large industries, combining with them, just as a natural part of the national life, its military organization. Here the two fitted in one with the other. This was what he wanted to see. He was quite sure it was good for everybody concerned. The spirit of the whole scheme, and the sense of responsibility for the defence of these shores, made men of them all when they took part in it. He was proud to see the splendid work that had been done there by everybody—from the Directors to those who had responded to their invitation and thrown themselves into this national task. He was proud to have seen the proof that day that he was right in the idea he had always entertained—that the men of England had it in them, consistent with their daily avocations, to make themselves an efficient military force. They all knew the difficulties, and that they would have to put their very souls into the movement to get up to the requisite level. It had been a satisfaction to him to visit Beckton; and he would go back with a feeling of pleasure that he had seen his own children prospering.

Hearty cheers having been given for Mr. Haldane and the Governor, a move was made to a saloon which was in waiting to take the Minister round the works. During the journey, it may be mentioned, a stop was made at No. 12 retort-house, where the Fiddes-Aldridge machine was seen in action. On returning, a party of about thirty sat down to luncheon, with the Governor in the chair.

Mr. U. K. Burke, after the Loyal Toasts had been duly honoured, proposed the "British Army;" remarking that they had in the present Secretary of State for War a man than whom no one had done more with the material he had at hand.

The Right Hon. R. B. Haldane, responding, admitted that he was under no illusions with regard to the extreme difficulties of the problem of the army in this country. Both officially and personally he felt much indebted to the Gaslight and Coke Company for the way in which they had entered into this great undertaking of evolving a national force out of the citizens. They all saw how hard it was. They could not give persons engaged in civilian enterprises any long period of training. It was only by cordial co-operation with the employers that they could give them any training at all. If they were organizing a civilian force, all they could get, unless they were prepared to go in for two or three years' compulsory training, would be a force which would be a perfect organization in times of peace, but which would require a "good deal of water running under the bridge" before it would be able to hold its own, man to man, with such people as it would be likely to have to meet when at war. The scheme was, however, the best they could do, unless they were willing to turn to compulsory service. They had in this country a most intricate and difficult problem to face. He thanked them for the reception they had given him; and above all he thanked the Company for what they had done in showing what a real thing the work of creating a citizen force could be made.

Here Mr. Haldane had to leave in order to keep an engagement in Westminster. The Governor accompanied him.

The Bishop of Barking, in proposing "Prosperity to the Gaslight and Coke Company," said that this undertaking, with its 12,000 employees, was setting to others a grand example in patriotism.

Mr. John Miles, in reply, agreed that out of the thousands of men employed by the Company, a great many were doing good work for their country. The important thing in a concern like this was control. A number of the men were controlled by Mr. Reeson; and he kept them under excellent control. Mr. Reeson was controlled by the Chief Engineer (Mr. Goulden), who was controlled by the Governor; and the Governor was controlled—perhaps—by the Directors. The results were excellent. There was a time when 10,000 feet of gas per ton of coal was considered very good working; but now it was 12,000 feet, and more. This meant a great deal; and it had really all been done by hard work on the part of the Engineers. So long as they were served so well by the staff, and had a Governor so zealous in looking after the welfare of the undertaking, he felt convinced that the prosperity of the Company would continue.

AN ACETYLENE TEXT-BOOK FOR CHEMISTS.*

The text-book on acetylene which is now before us forms the second volume of the series of books on Chemical Technology which is being issued by the publishing house of Otto Spamer, of Leipzig. The first volume of the series, by Dr. Ferd. Fischer, dealt with power gas, and was favourably noticed in a recent number of the "Journal" [*ante*, p. 21]. The author of the second book in the series—viz., Dr. J. H. Vogel, a Professor at Berlin, is well known as a leading authority in Germany on acetylene. His address from the presidential chair at the last meeting of the German Acetylene Association attracted considerable attention, and an abstract of it was given in the "Journal" at the close of last year [Vol. CXII., p. 944]. Dr. Vogel is also known as the Editor and Joint-Author with Dr. Caro and Dr. Ludwig of a comprehensive handbook on acetylene which was published seven years ago. He has also written some minor works dealing with particular aspects of the application of acetylene. Dr. Vogel has also acted as Editor since 1904 of "Carbid und Acetylen," which is the oldest of the German periodicals devoted to acetylene.

It is apparent that no better authority could have been found in Germany than Dr. Vogel for the authorship of a technical treatise on acetylene. The book under review aims at supplying to chemists in a concise manner up-to-date information on the properties, the production, and the applications of acetylene. It contains no information, except some particulars of quite recent advances in the application of inverted burners to acetylene lighting, which is not already available in English text-books, while it lacks the explanations contained in some of the latter which make them serviceable to readers who are not trained chemists. Dr. Vogel's work should prove extremely useful to the technical man in Germany who desires to have a compact, handy, and trustworthy book of reference to what has been done in the investigation of the properties of acetylene, of its method of production, and its after-treatment, and of the most advantageous means of employing it for lighting and other purposes. The limitation by us of its field of usefulness to technical men in Germany is made advisedly, because the insularity of the modern German technical author is conspicuously displayed in it. One fact which strikes more than any other the English or French reviewer of modern technical works by German authors, is the evident confidence of the latter in the all-sufficiency of German authorities and German sources of information upon technical subjects. The immense advance in technology made in Germany in the last half-century is evidently assumed by German technologists to justify this attitude; but in regard to acetylene (to speak for the moment only of the subject of the present review), there is no question that technical knowledge is in a more advanced state in France at the present time than in Germany, and is in at least as forward a position in England and America as it is in the latter country. Yet the otherwise uninformed reader of Dr. Vogel's present work would be deluded by it into the belief that practically nothing had been done in regard to acetylene in England since Professor Lewes introduced it to the knowledge of English technical men, and wrote his comprehensive treatise on it in 1900; or in America since Willson first showed the production of calcium carbide in the electric furnace. The immense amount of patient research work done in connection with the Office Central de l'Acétylène in Paris in recent years does not seem, from the volume before us, to have been sufficiently assimilated by Dr. Vogel. Especially noticeable is the incompleteness of the bibliography which appears at the end of the volume in respect of works on acetylene in the English language.

Apart from these strictures, however, Dr. Vogel's work is a very

* Das Acetylen, seine Eigenschaften, seine Herstellung und Verwendung, von Professor Dr. J. H. Vogel, Berlin. Leipzig, 1911; Otto Spamer.

satisfactory production. He deals first with the physical properties of acetylene, and here, as elsewhere in the book, indicates the authorities for his statements. Next he deals fully with the chemical properties of acetylene; and then gives a section on its hygienic qualities. In this connection some comparisons are made of the relative effects on the atmosphere of different methods of lighting. The relative production of carbonic acid from coal gas and from acetylene for the same lighting effect purports to be shown by figures which are very unfair to coal gas. It is untrue, as is implied by figures quoted by Dr. Vogel, that light for light a flat-flame coal-gas burner produces 11 to 12 times as much carbonic acid as an acetylene open-flame burner. Also it is hardly correct to state, as is done, that it may be assumed, from theoretical considerations, that the incandescent acetylene light is superior in respect of smallness of vitiation of the air to incandescent coal gas lighting. The comparisons profess to be made on the basis of equal yield of light. If we turn to corresponding figures given by Leeds and Butterfield in their text-book on acetylene, it will be found that they put the production of carbonic acid from flat-flame coal-gas burners at only four to five times that from acetylene burners for the same production of light, while the carbonic acid produced from the incandescent coal-gas burner is slightly less than that from an incandescent acetylene burner of the same power. Similarly in regard to the heat produced, the figures quoted by Dr. Vogel differ from those given by the same authorities. The respective positions of incandescent coal-gas lighting and open-flame acetylene lighting in regard to the production of heat appear to have been reversed by the investigators quoted by Dr. Vogel. These are points as to which there can be little question; and it seems a pity that Dr. Vogel did not revise, from his own knowledge, the information which he gives on them. No advantage will accrue to acetylene by ascribing to it advantages over coal gas which it does not in reality possess. It is not only useless, but misleading.

Dr. Vogel then deals with the estimation of the yield of acetylene from carbide. He follows the methods of the German Acetylene Association, which have already been described in English text-books. His next section relates to the impurities in crude acetylene, and is followed by a section on purification. In these sections, as well as in those on the physical and chemical properties of acetylene, and others relating to the analysis and application of the gas, Dr. Vogel has had the collaboration of Dr. Armin Schulze, of Berlin. The section on purification is appropriately followed by a section on the analysis of acetylene. Then comes an important section on the technical production of acetylene, in which the author has had the valuable assistance of Dr. Anton Levy, of Berlin. In this section, an attempt is made to discuss both the underlying principles and the technical manufacture of acetylene, and at the same time to describe a number of examples of generating apparatus as now put upon the market. The examples given are almost exclusively of German origin; and we have not noticed that any of the modern French and American generators, some of which have been produced in large numbers, are described.

A section is next given, on the equipment and working of acetylene installations, written by Herr Alfred Schneider, of Chemnitz. Then follows a section on dissolved acetylene, and the applications for which it is best adapted, by Dr. Paul Wolff, of Berlin. The ensuing section, on the use of acetylene for lighting purposes, starts with a description of open-flame burners for acetylene and concludes with an account of incandescent burners, both upright and inverted. Curiously enough the successful French incandescent burner, known as the "O.C.A.," and the Bray incandescent burner appear to have escaped the notice of the author and Dr. Schulze, who are jointly responsible for this section. Two types of inverted acetylene burners are described—those of Schimek, and the Berlin Anhalt Engineering Company; but it may be said broadly that inverted lighting by means of acetylene has scarcely yet passed beyond the experimental stage.

Autogenous welding and the general working of metals by means of acetylene are dealt with in the next section. In this section, it is gratifying to note that the author and his collaborator Dr. Schulze have availed themselves of the latest advances and researches by French acetylenists, who have made this field of application of acetylene to industrial purposes peculiarly their own. A section on the use of acetylene for boiling and cooking purposes is necessarily brief; and still briefer is the following section on acetylene as a fuel for internal combustion engines. A section of considerable interest to the chemist is that which deals with acetylene as a raw material for the manufacture of various chemical products. The use of the gas in laboratories where coal gas is not available is dealt with in the next and final section of the work.

An appendix comprises reprints of the "Official Regulations" of the Prussian Government with regard to the manufacture and use of acetylene and the storage of calcium carbide, and of the "Technical Rules" issued by the German Acetylene Association. The corresponding regulations of other countries, even of those—*e.g.*, Austria and Switzerland—where German is spoken, are not quoted or referred to. The inadequacy of the bibliography with which the book concludes has been already referred to. There are indexes of names and subjects which appear to be sufficiently comprehensive.

We have said enough to indicate that Dr. Vogel's book will be indispensable to German chemists interested in acetylene, and of great service to their colleagues in other countries.

PERSONAL.

Mr. A. R. Wyatt, of Denbigh, has been appointed Manager of the Seaton (Devon) Gas-Works, in succession to the late Mr. H. S. Charlesworth. There were 108 applications for the position. Mr. Wyatt holds a first-class certificate in the Honours Grade in "Gas Engineering," is a bronze medallist in "Gas Manufacture," and also holds a first-class ordinary certificate in "Gas Supply."

Last Thursday week, at St. John's Church, Barnsley, the marriage took place of Mr. Harold H. Hutchinson, the eldest son of Mr. W. W. and Mrs. Hutchinson, and Miss Florrie Outwin, of Park Road, Barnsley. The bridegroom is Assistant Manager and Secretary of the Barnsley Gas Company, and is well known in the town. After the ceremony, a reception was held at the Queen's Hotel. There were numerous beautiful presents, including a case of cutlery from the workpeople at the gas-works, with suitable inscription, and a silver salver from the office staff.

OBITUARY.

The death occurred on the 24th ult., from double pneumonia, of Mr. Robert Midgley, the Manager of the Skibbereen Gas Company. The management of the works was taken over by deceased five years ago; and the progress made under his care was repeatedly acknowledged by the Directors. He leaves a widow and one son to mourn their loss. The interment took place in the Abbey Cemetery; the *cortége* being over half-a-mile in length. In fact, it may fairly be said that the funeral was remarkable for the spontaneous expression of regret by all classes and creeds.

Mr. Ben Stocks, whose death occurred recently, and who had nearly attained 73 years of age, was a well-known Huddersfield architect. For sixteen years he was a member of the Huddersfield Town Council, to the aldermanic bench of which he was elected in 1892—retiring in 1901. Mr. Stocks occupied the position of Chairman of the Gas Committee for many years; and it was he who was instrumental in the appointment of a competent Assistant to help Mr. Burgess, the then Engineer, when, in 1891, that gentleman's physical condition was such as to render the discharge of his duties almost impossible. Mr. Stocks was a man of practical ideas and forceful character, and took the deepest interest in the work of the gas undertaking; and it was to a very large extent by him that the reconstruction scheme, afterwards carried out by Mr. W. R. Herring during his management of the works, was initiated in the first instance. Various modern appliances which were at that date novelties were introduced—in the shape of inclined retorts and coal-handling plant. The effect of this reconstruction scheme was duly recorded at the time; and it is not too much to say that Huddersfield has benefited largely from the initiative of the late Chairman of the Gas Committee.

Retirement of Mr. Henry Smythe.

We are sorry to learn that Mr. Henry J. Smythe, the Engineer and General Manager of the Maidstone Gas Company, will shortly relinquish this position on account of ill-health. Mr. Smythe served his apprenticeship with Messrs. Henry Balfour and Co., of Leven, Fife, and afterwards worked for a short time under Mr. Cathels at the Crystal Palace District Gas-Works (now South Suburban). From there he went to erect, and afterwards manage, the Bute Gas-Works, Cardiff. He was Manager of the Callao (Peru) Gas Company for about four years, but returned to England owing to the state of his health. He became Assistant to Mr. John West at Maidstone, and afterwards succeeded him when he was appointed Chief Engineer of the Manchester Corporation Gas-Works in 1880. During the 31 years of his management, the annual sale of gas has increased threefold; the price of gas has been reduced from 3s. 3d. to the present figure of 2s. 6d. per 1000 cubic feet; and mains have lately been laid down to supply nineteen additional parishes. Mr. Smythe has always taken a keen interest in the welfare of the Company's workmen; and though he did not have the privilege of helping them to get the benefits of the co-partnership system, some few years ago, he assisted in introducing an "employees gas stock purchase fund," which many of the employees eagerly take advantage of to become proprietors of the Company's stock. Mr. Smythe joined the Gas Institute in 1882, and he is a member of the present Institution, as well as of the Southern District Association of Gas Engineers and Managers, of which he was President in 1894. The good wishes of his many friends will be extended to him in his retirement.

We have received from the Secretary of the Gaslight and Coke Company (Mr. Henry Rayner) the third number of the Company's "Co-Partners' Magazine." It contains two interesting photographs—one of the rental department at the Horseferry Road, and the other of the Company's reconstructed exhibit of products at the Brussels Exhibition. The extent of the business in the rental department of the Company is shown by the fact that it requires 161 ledger clerks, 26 cashier clerks, 91 ordinary collectors, 136 automatic meter collectors, and 98 bag carriers—516 in all—to cope with it. For their exhibit at Brussels the Company received a grand prize—the highest possible award. A similar collection of products is now in preparation for the Turin Exhibition.

RATING OF GAS AND WATER UNDERTAKINGS,

WITH AN OUTLINE OF GENERAL PROCEDURE OUTSIDE THE METROPOLIS.

By Arthur Valon, Assoc.M.Inst.C.E.

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III.

Gas Undertakings.

Tenant's Capital.

Capital is required by the tenant to enable him to meet the ordinary working expenses of the concern during the period which must elapse before the current receipts are equal to the current expenditure, and also to purchase meters, tools, implements, stocks, and stores which it is the tenant's duty to provide, and the apparatus which, it has been decided, it is the business of the tenant to supply to the consumer, and which, owing to the great expansion of business during recent years, is responsible for a great and increasing proportion of the tenant's capital.

Working Expenses.—The accounts for gas consumed are, in nearly all cases, rendered quarterly; and it is some six weeks or two months after the end of the quarter before the money received from day to day will be sufficient to meet the outgoings. Capital must therefore be provided to meet the excess of expenditure over receipts during a period of 4½ or 5 months. Although the ordinary gas accounts are only rendered quarterly, there will be a considerable sum received during the quarter from various sources; and the method ordinarily adopted for calculating the net amount of capital required for working expenses is to take 4½ or 5 average months expenditure, and to deduct from this the receipts during that time from prepayment meters, residuals, and supplemental rental.

In the absence of any direction as to the date on which it is to be assumed that the tenancy will begin, it is the practice to deal with average months rather than actual months. An average month's expenditure is understood to be one-twelfth of the total annual expenditure.

The actual amount collected from prepayment meters which will be available to reduce the working capital required to meet expenses will, when (as is customary) slot meters are in use, be the total sum which has been collected from the meters. It may be pointed out that slot meters are generally cleared every month or six weeks; and therefore there will always be some money in the meters uncollected.

Some proportion of the residuals, such as coke and tar, are paid for at the time of sale; and when credit is given, the account is, as a rule, rendered monthly. The full amount received from the cash sales during 4½ or 5 months should be deducted; but the credit sales should be reduced in proportion to the length of credit given. For instance, if a quantity of coke is sold during five months, and paid for a month after delivery, the receipts during the five months will only be for the coke supplied during four months.

Supplemental Rental.—When consumers remove from one house to another, or cease to take a supply of gas, the account is rendered at once; and there are also cases where the accounts are paid at shorter intervals than the quarter. The money received in these ways is termed "supplemental rental;" and the total received during the period for which it is assumed that working capital is required should be deducted as available to meet expenses.

Rates.—As the expenditure on rates was excluded from the revenue account, nothing will have been included in the allowance of capital for working expenses; and therefore any payment for rates which must be made in the first 4½ or 5 months must be added to the working capital required. Rates are usually made half-yearly, but very frequently payment may be made in two instalments; and in this case, three months rates may be allowed. Some valuers add the annual cost of rates to the total working expenses before calculating the working capital—thus allowing 4½ or 5 months rates.

Stock of Coal.—In the amount allowed for coal under the head of tenant's expenses was included the cost of coal required for the manufacture of gas during the 4½ or 5 months. But in addition to the actual quantity required for carbonization, a certain stock must be provided to keep the works going during the intervals between the deliveries, or at any time when the supply of coal is less than the amount consumed. The actual quantity required for this purpose will depend upon the position of the works in regard to the coalfields, and the method of transit; but it may be mentioned that six weeks stock is a figure commonly adopted under average conditions.

Stock of Residuals.—The incoming tenant will need to take over from the outgoing tenant the stock of residuals, and should be allowed the capital necessary for this purpose. It has occasionally been suggested that the tenant would start clear, and decline to take over any stocks, and therefore that this allowance should not be made. But this ignores the fact that a stock is necessary owing to the fluctuations in supply and demand, and in order to get the best advantage of the market. If it be assumed that at the beginning of a tenancy no stock existed, it would probably be necessary to accumulate one during the first few months, in which case the receipts from residuals, which are allowed as a deduction from the working capital, would be less by this amount, and the total tenant's capital would not be altered. Further, the prices actually realized for residuals depend to some extent upon the ability to accumulate stock; and if it is to be assumed that all residuals are sold as produced, an adjustment of receipts would need to be made. It is, however, far simpler, and fairer, to deal with the matter by allowing the incoming tenant sufficient cash to take over the stock of residuals which it has been found by experience it is usual to have in hand for the profitable working of the undertaking.

Sundry Stores, Tools, and Office Furniture.—The value of the necessary stores, the tools, as well as the office furniture must be included.

Meters in Use and in Stock.—The capital required to provide the meters is calculated by taking the market price, adding stamping fees and cost of fixing, and deducting something for depreciation, according to the state in which the meters are kept and the length of time they have been in use. As has been indicated, the depreciation allowed will vary; but the amount will seldom be less than 20 per cent., or more than one-third. It is sometimes suggested that there is no depreciation on the cost of fixing; but as when a meter is worn out it has to be removed, and the fixing will have to be done again, the whole value of it is depreciated during the life of the meter, or sooner if the meter is removed for repair. It has at times been contended that the meters should be valued at their cost when new, allowing no depreciation. But this is contrary to the general practice. A new tenant coming in would, in all probability, take over the meters from the old tenant, but certainly would not pay the full first cost of them regardless of their condition. It is true that all the meters were new once, and that therefore there has been wastage of capital to the extent of the depreciation. But all capital invested in perishable articles is subject to this wastage; and the tenant is compensated for this by the cost of maintenance allowed in the revenue expenditure being sufficient not only to meet actual repairs, but also depreciation—*i.e.*, liability for renewals which have not become objective.

Stoves in Use and in Stock.—The remarks upon meters apply also to stoves; but the rate of depreciation is usually higher—commonly one-third, depending upon their average age and their condition.

Prepayment Consumers' Pipes and Fittings.—It has now been decided that these pipes and fittings are to be taken as provided by the tenant; and the cost has therefore to be included in the tenant's capital. Their value will be considerably less than the original cost; the depreciation being frequently 50 per cent.

Cash at Bank.—The assumption upon which the tenant's capital is based is that the whole of it will be required at one time, even though that time be short. Consequently, if the bank make it a condition of keeping the account that a minimum balance be kept, this minimum balance must be allowed as cash at bank.

Deposits.—In the accounts of gas undertakings, the amount received from consumers for deposits is usually carried to the balance-sheet. The total sum is almost invariably deducted in the tenant's capital as being cash in hand; and if this be done, the interest which is paid should be added to the tenant's share.

Tenant's Share.

The tenant's share is, as a rule, calculated by taking a percentage of the tenant's capital; and this is assumed to cover the whole return required by the tenant, not only for the use of the capital he provides, but also for his ability and enterprise, which do not necessarily bear any definite relation to the capital employed. The percentage usually taken was, for many years, 17½—a practice which apparently first arose in London as a compromise between higher and the lower figures put forward by the two parties in appeals. It was this figure which was claimed by Mr. Edward Ryde in the Lee case, so important in another connection; and it was adopted by the Court, although it was contended for the rating authorities that 15 per cent. was sufficient. The argument in favour of 17½ per cent. was based upon an analysis of the tenant's share into three parts—interest, trade profits, and risks and casualties—and attaching to these respectively 5 per cent., 10 per cent., and 2½ per cent. With the prestige afforded by the decisions in the London Courts, it became a settled custom throughout the country; and for a considerable period it was a waste of time to attempt to argue for any other basis of calculation. But in spite of the fact that the attempt was a forlorn hope, the rating authorities from time to time contended for a lower figure, although with little success.

In 1892, in the appeal of the Gaslight and Coke Company *v.* City of London Union, the respondents suggested that an average of 15 per cent. was sufficient—arrived at by taking varying percentages upon the different items composing the tenant's capital. But the decision of the Court did not state the amount of the tenant's share.

In the South Metropolitan Gas Company's appeal in 1897, the Chairman, Mr. M'Connell, in the course of the proceedings said:

> I think, gentlemen—I do not know whether it will assist you or not—the Court is not disposed to depart from the 17½ per cent. so far as it is applicable. We do not say that it is to apply to all the items. In the case already before us, we should apply it; and as a matter of general application, we will not depart from the 17½ per cent. which has hitherto been the rule.

In 1902, in the Poole case (Poole Gas Company *v.* Poole Union) 12½ per cent. only was allowed; and the Recorder in giving judgment said:

> It was always the rule to allow 17½ per cent. on the tenant's capital; but, without going into detail, he would say—and people ought to

know it—that, in his opinion, 17½ per cent. was a great deal too much. The origin of this arose in the days of the Duke of Wellington. But money had since depreciated, and they had also the chance of a concern not turning out successfully. Although, therefore, they might in some exceptional circumstances allow 17½ per cent., or even more, he thought that, as a rule, 12½ per cent. was as much as could be expected. [See "JOURNAL OF GAS LIGHTING," Feb. 11, 1902, p. 356.]

In 1907, the South Metropolitan Gas Company again appealed against their assessment, and Mr. Wallace, K.C., before whom the appeal was heard, said, in the course of his judgment:

I want also to say this in regard to what is called the percentage that ought to be allowed upon the tenant's capital. Again, I decline absolutely to recognize, and I understand that all my colleagues agree, that any percentage is fixed either by this Court or by anyone. The percentage has to be taken into consideration in regard to every particular case, and having regard to all the varying elements which come into each particular case. A case of this kind, a case of a company established, progressive, largely receiving its receipts in cash, or within so short a period that it almost amounts to cash, enjoying a monopoly of its own trade by Statute within its district, I do not mean a monopoly against other competitors of course—all these are elements to be taken into consideration; and we neither name 17½ per cent., or 15 per cent., or 12½ per cent., or any other figure.

As the assessment appeals in London are decided at the sessions of which Mr. Wallace is Chairman, the foregoing remarks are of serious moment as indicating that the traditional 17½ per cent. is no longer to be allowed, as it had been for many years, almost as a matter of course. Unfortunately, the judgment, although it destroyed the sanctity of a tradition, did not give any indication of what the Court thought would be a more reasonable substitute; and yet, unless complete chaos is to reign, it will undoubtedly be necessary that some basis for the calculation of the tenant's share, which will commend itself to the Court, should be determined. Without this, endless controversy and litigation must ensue, unless what is felt to be an injustice is submitted to rather than face certain heavy expenditure to obtain a decision which may be founded on principles not much more rational than a lottery.

There are certain factors which must always enter into any rational calculation of the proportion of the profits which must be conceded to a tenant in order to let the undertaking, whatever differences of opinion may legitimately exist as to the relation between tenant's share and tenant's capital. The first point which any prospective tenant would need to consider would be the rate at which the necessary capital could be raised. This rate will depend upon the state of the Money Market, and may be fairly taken at the probable average rate at which money can be borrowed on good security during the time for which it is required. It must be assumed that any prospective tenant must either himself possess the requisite capital or be able to furnish sufficient security to enable it to be borrowed. Whether a tenant uses his own money or borrows, he will, in either case, expect to obtain, as a practicable certainty, the usual rate of return for money lent on good security; for if he borrows the money, he will himself be bound to pay the interest, whatever might be the success attending his carrying on of the business of gas supply, and as he could invest his own money on good security, he would not use it in a business without the same security of a similar return.

Having provided for the bare interest payable for the use of the capital, a tenant would probably next proceed to consider how he could secure that under any reasonably possible circumstances his share of the profit made would be sufficient to cover this interest. Or, to put it in another way, the tenant should have the same security of obtaining out of the profits of the business a sufficient sum to cover the interest on his capital as the bank from which he has borrowed the money has, that he will meet the interest due to them. It will be clear that if it could be guaranteed that the actual profits would be not less than the estimated profits, the security of the tenant would be perfect; and if provision were made for the safety of the capital invested, all that would be required in addition to the interest on capital, would be a sufficient return to cover the tenant's time and skill, and the responsibility devolving upon him.

In order to secure the interest on the money, it will evidently be necessary to allow a sufficient margin to cover the fluctuations in the profit which experience shows may be reasonably expected to occur. Although the profit from a gas undertaking does not usually vary so much from year to year as in many other trade concerns, yet an examination of the accounts of most undertakings will show considerable differences between one year and another; alterations in the cost of coal, or in the prices obtainable for residuals, being the most usual causes. In addition, loss may be occasioned by labour troubles, explosions, spontaneous combustion of coal, or accidents which may damage the tenant's chattels.

This risk of fluctuation in the amount of profit yielded by the business appears to have been treated in most cases as part of the item "Trade Profit" as set out in the Phœnix case, and not as part of "Risks and Casualties;" and it is quite right that the two things should be treated together. If proper provision is made against fluctuations, it seems reasonable to suppose that a tenant would be satisfied with a comparatively small additional return, beyond the rate of interest on borrowed money; for the reason that he would be quite certain of this small return in a bad year, and in a good year he would make a larger profit, which, on the average, would pay him well. The extent of the provision it is necessary to make against fluctuations will vary with different undertakings; and it should be pointed out that, although the variation in the profit may be a comparatively small percentage on the total capital of the undertaking, it will bear a correspondingly larger proportion to the much smaller tenant's capital.

The high percentage generally claimed for the tenant's share upon his capital has been at times compared with the low rate at which capital can be obtained by companies which are both landlord and tenant; and it has been implied that the two rates should be approximately alike. But in contrasting the position of a tenant with that of a company which is landlord and tenant, it should be remembered that in the case of the former the rent must be paid in any case, whatever the result of the year's trading may be; and therefore the whole variation in profit will fall upon the tenant's share. And, further, that in the case of a landlord and tenant company, a bad year means merely a diminished dividend on the shares; but in the case of a tenant company, there would very likely be no dividend at all, and possibly the tenant would have to borrow money, or realize his capital, to pay the rent—a disastrous end.

The reputed security of investments in gas companies is high; and, consequently, the price of the shares is such that the rate of return obtained upon the investment is small. It is therefore not unnatural that comparisons should be made between this rate and the comparatively high rate which it is claimed would be necessary to induce a tenant to carry on the business. A company, formed for the purpose, may be considered as a tenant of an undertaking; and if proper allowance is made for the points wherein it differs from a company owning and working the undertaking, it should be possible to arrive at the equivalent return which the tenant company would require. In any particular case it should, however, be remembered that the actual price of the shares is only evidence of the successful working of the existing company, and may be the result of careful management over a long period, and the exercise of the experience gained during such period. It does not necessarily follow—indeed, it is not probable—that a new company would be able to raise the necessary capital at so low a rate, unless there was a prospect of materially larger profits in the future. If, therefore, the dividend the shares yield upon investment of any company is taken as a basis of calculation, this will be the first point to which consideration must be given.

In the next place, there is the question of security of tenure. According to the Statute, the rent is to be calculated on the assumption of a yearly tenancy; but it has been laid down that a reasonable prospect of continuance is to be assumed. There must, however, be some risk of a termination of the tenancy, which must be provided against out of the tenant's share.

In addition to these two preliminary points, there is the main question of the security of the expected dividend. Although the supply of gas cannot be looked upon as a highly speculative business, experience shows that considerable fluctuations of profit occur as between one year and another. The effect of these fluctuations upon the dividend is provided against by the accumulation of funds authorized by Statute, and by the existence of a reserve of undivided profit; while the apparent variations in profit often appear smaller than they are owing to expenditure—notably on repairs and maintenance—being postponed in bad years and anticipated under more favourable circumstances.

There can, of course, be no doubt that the proportion the tenant's share will bear to the tenant's capital may vary with different undertakings, and according to the circumstances; and it was decided, as far back as 1863, in the appeal of the Sheffield Gas Company—and confirmed in the Ipswich appeal of 1907—that the proper rate to be allowed for tenant's profits and interest on capital was entirely a question of fact. There are, however, many advantages in the general adoption of some definite percentage, which would be fairly applicable to average cases; for although it is a comparatively simple matter to state the considerations which will affect the amount of a tenant's share, it is an extremely difficult thing to find a firm basis of fact for calculating the actual return in any particular case. Consequently, the matter being often purely one of opinion, it gives broad ground for controversy and litigation, with the unfortunate possibility that the actual decision, when arrived at, may be the result rather of accident than of evidence.

Having decided on the amount of the tenant's share, it has to be deducted from the net receipts; and the remainder will be the gross estimated rental, including also the amount payable in rates, where this has not been previously deducted.

LANDLORD'S STATUTABLES.

Section I. of the Parochial Assessments Act, 1836, provides that, in arriving at the rateable value, there is to be deducted from the rent "the probable average annual cost of the repairs, insurance, and other expenses (if any) necessary to maintain them [the hereditaments] in a state to command such rent." In the case of gas-works, these deductions will comprise the expenditure for repair and maintenance of the works, plant, mains, and service pipes—*i.e.*, of everything pertaining to the undertaking except the tenant's chattels, together with an amount for insurance.

Repairs.—From the provision of the Act, it will be observed that the proper deduction is not the amount expended upon maintenance during any particular year, but the amount which would need to be expended upon the average. This may be estimated in several ways. If the undertaking has been fully maintained for a long period of years, it may be sufficient to take the average of the actual expenditure. But in doing this, where the output of

the undertaking has altered, it will be necessary to calculate the expenditure per 1000 cubic feet of gas sold, and apply this figure to the output in the account year. This method will not be available where the undertaking has not been fully maintained, and cannot be applied to new works, where, as a matter of course, the expenditure upon repairs over a considerable period would be much lower than the average. Neither is it strictly applicable where a small works has very rapidly increased in size, as the rate per 1000 cubic feet on the small works might be very different from that necessary for the larger one. In these cases, the expenditure must be estimated in the light of general experience.

In cases where the works have not been fully maintained, and their condition has affected the profits, and, consequently, the rent obtainable, the cost of maintaining the hereditament in the same state can alone be claimed, and not a higher expenditure, however desirable this might be on general grounds, because this would mean the maintenance of the hereditament in a state to command a higher rent, which is not in accordance with the Statute.

In dealing with the actual expenditure shown in the accounts, it is desirable to make quite sure that only the cost of maintenance is included, as it is not unusual for the cost of extensions of the undertaking to be partly defrayed out of revenue, and the amount placed under the head of repairs and maintenance.

Where the amount claimed for repairs is not sufficient to cover renewals also, the sum it will be necessary to pay into a sinking fund to renew buildings and plant may be claimed in addition.

Insurance.—The cost of insurance may be deducted, whether the works are actually insured or not. Where the cost of insurance appears in the revenue account, it must be placed under the head of landlord's statutables, and not under tenant's expenses.

Having deducted the landlord's statutables, the amount remaining will comprise the rateable value and the expenditure on rates. If the amount of the rates per pound of rateable value is known, the rateable value may be found by a simple proportion thus—assuming the rates to be 8s. in the pound: As £1 8s. is to £1, so is rateable value *plus* rates to the rateable value.

THE FUNCTIONS OF AN INSTITUTION.

By An Assoc. M. I. Gas E.

Having read with much interest the views of your correspondent "Assoc.M.Inst.C.E." on the above subject in recent issues of the "Journal," it may be pointed out that there is a further outlet for considerable usefulness—referring throughout this article to the Institution of Gas Engineers. One has heard and read so much lately of what this body could and should do, that to mention anything further is almost like "thrashing a dead horse." This, however, by the way.

Let us consider, then, the reasons of its formation. Without discussing the whole of the Articles of Association, No. 3 (*d*) will suffice. This runs as follows: "To invite from members communications relating to gas engineering, manufacture, and administration, and to receive, hear, and discuss such communications at meetings of the Institution or elsewhere;" and, further, part of (*c*) "to generally aid, promote, and encourage the acquisition and diffusion of knowledge concerning the production, application, and distribution of gas."

It is here seen that part of the functions of the Institution is to encourage the diffusion and acquisition of knowledge. Very well. How does it set about it? By the exhilarating process of a scientific meeting once a a year! Realize all that this means—*once* a year!! [The Commercial Section and its connection with the District Association has no bearing on this point.] I am strongly of opinion that once a year is not by any means sufficient if the Institution is to be considered as a live body; and here I may be allowed to quote a statement by your correspondent, "Assoc.M. Inst.C.E.:" "As a consequence of this initial defect, of course, there can be no effective motive power urging the scattered gas forces into any direct and profitable channel."

Surely a meeting once a month would be better (though it should be remembered that the Institution has no permanent home). Of course, to this objections, well worn, will be at once raised. But such objections being well known, need not be discussed; the reader can answer them as he wills, and to his own satisfaction. Full members will state the difficulties of getting away, heavy pressure of business, &c. But if a member were not particularly interested in the subject to be raised on any particular night, he would stay away. Monthly meetings, moreover, would not extend over three days or so, but merely for a few hours one evening. Apart from the full members, think of the advantages such meetings would be to the associate members and to the students. Short papers could be read and discussed, and so members would acquire useful information and gain that *camaraderie* and bond of sympathy that is so much spoken of.

As this would apply and appeal more particularly to the London members—which is not the object aimed at, but to the members generally—all this points to the formation of Local Sections, each having its own Honorary Secretary. The meeting places could, I think, be very easily arranged (as probably not more than ten members would attend), as gas-works generally have some form of recreation room on the works, where a few like this could meet, or the drawing office or laboratory could be used for the purpose. No gas officials would, I am sure, grudge the few feet of gas that would be burned, or the use of the room. Each Honorary Secretary) would report to Mr. Dunn, who would arrange with the Publications Committee as to whether the communications should be published in the "Transactions." If there were many additional papers, it would increase the cost of publishing the yearly volume; but this could easily be arranged by advancing the subscription to (say) a guinea-and-a-half, which I feel sure all classes of members would be pleased to pay if they knew they would get something for their money over and above a meeting once a year. Think of the bonds of sympathy that would arise among the members forming each Local Section. Difficulties could be discussed—if need be quite informally, and without the "fear" of Press reporters, and the chance of showing one's ignorance before the "big pots" of the profession.

The suggestion here put forward has, to the writer's mind, everything to recommend it, and much would be gained to the individual members, at practically no extra cost to the Institution as a body. The Society of Chemical Industry appear to work on similar lines, with much advantage to themselves. Why not the gas industry?

In conclusion, it may be remarked that this would have no bearing to the disadvantage of the Junior Associations, as there are not many members or (say) associate members and students of the Institution who at present belong to Junior Associations also.

Enough has been said to show that the idea is worthy of the fullest consideration. But will it get it? Many other suggestions have been made from time to time; they also have died at birth.

Presentation to Mr. W. W. Gray, of Cambridge.

The completion of twenty-five years' service as Engineer and Manager of the Cambridge University and Town Water-Works Company, with which undertaking he has been associated for forty-five years, in the above-named capacities and also as Secretary, was chosen by the Company's staff as a suitable occasion for expressing to him in a tangible manner the respect and esteem in which he is held by them. This was done at a dinner held at the Lion Hotel, Cambridge, at which the Mayor (Alderman George Stace), who is one of Mr. Gray's oldest friends, presided. The presentation took the form of a gold sapphire ring, an enlarged portrait of the recipient, and framed photographs of the Company's pumping-stations at Cherryhinton and Fulbourn. Mr. J. F. Constable, as the senior member of the office staff, asked Mr. Gray to accept these gifts, and expressed the appreciation of the staff of the kindness he had shown them. He said they had always looked upon him as a friend, and one who invariably had their welfare at heart. The whole of the staff had taken up the presentation in a really spontaneous manner. Mr. P. A. French, the Chief Clerk, supporting these remarks, referred in detail to Mr. Gray's connection with the Company since 1866. Other members of the staff having spoken, the Mayor, in handing the gifts to Mr. Gray, endorsed the kind expressions used by the previous speakers, and mentioned that from his own personal experience he knew how interested Mr. Gray was in the welfare of the staff. Mr. Gray, in acknowledging the gifts, briefly reviewed his connection with the Company from 1866 to the year 1884, when he was appointed Manager. Two years later, he was made Engineer; and in 1897 he was appointed Secretary. In conclusion, he said he was very glad to know that what services he had rendered to the staff had been appreciated. It had always been his aim to look after their welfare. He would long remember the evening, and trusted those present would continue to work with him in the interest of the Company, as they had done in the past. Mr. P. H. Lilley, the Vice-Chairman of the Company, proposed "The Health of the Mayor," and, on behalf of those present, thanked him for his kindness in attending the function. The Mayor, in response, expressed his pleasure at assisting at the presentation.

Examination Scheme of the Institution of Municipal Engineers.—We learn from the "Journal of the Institution of Municipal Engineers" for last month that arrangements have been completed for the holding of examinations under the auspices of the Institution, and that a Board of Examiners has been constituted on which are Mr. J. H. Crowther, Gas and Water Engineer to the Wallasey Corporation, Mr. Frank Latham, Borough Surveyor and Engineer of the water-works, harbour, and docks at Penzance, Mr. Henry O'Connor, F.R.S.E., Past-President of the Society of Engineers, and Mr. R. O. Wynne-Roberts, M.Inst.C.E. The examinations will consist of a general paper which may be taken at any time, irrespective of age (but which is compulsory on all candidates), and special papers, of which only three may be taken at one time, and for which only candidates over twenty-five years of age may sit. In these are included the manufacture, distribution, and utilization of gas for lighting, heating, and power purposes, and water supply and water-works construction. As a general rule, the examinations will be held in London; but others will take place from time to time in the Provinces. Every endeavour has been made to eliminate theory, except so far as it is necessary to be employed in the practical design and construction of engineering works; and, in order to emphasize the practical nature of the examinations, candidates will be allowed to take text-books into the room, so as to reproduce as far as possible the conditions under which they work in their own office. The entire control of the arrangements will be in the hands of the Board of Examiners.

SOCIETY OF BRITISH GAS INDUSTRIES.

Annual Meeting at Leeds University.

The Annual General Meeting of the Society was held last Friday, in the Hall of the University of Leeds (by permission of the University authorities). Formal business first engaged the consideration of members; and the first items were transacted with dispatch under the chairmanship of Mr. FRED. J. WEST.

The minutes of the meetings held last year were read by the Secretary (Mr. Arthur L. Griffith), and confirmed.

REPORT OF THE CENTRAL COUNCIL.

The following report of the Central Council was received and adopted:

In presenting the fifth annual report to the members of the Society, your Council have pleasure in reporting continued progress. During the past year, seventeen additional firms have become members; and your Council look forward to a further increase in membership in the near future.

During the last few months, the revision of the rules, rendered necessary by the growth of the Society, has engaged the attention of the Council; and they trust the new rules adopted at the Autumn meeting in November will strengthen and add to its usefulness.

The Council are pleased to note that the members are making full use of their respective sections, and hope they will continue to bring forward from time to time matters of interest for consideration.

The standard clauses of contract are being generally adopted, and are proving of great benefit to the parties concerned.

The Sub-Committee of the Fire-Brick Section have had several meetings with the Committee of the Refractory Materials Committee of the Institution of Gas Engineers, and a standard specification for fire-bricks has been adopted between the Institution and the Society.

Your Council are very pleased that the Livesey Professorship of Coal Gas and Fuel Industries has now been established at the University of Leeds as a memorial to the late Sir George Livesey, and confidently hope that this step will greatly benefit the whole of the gas industry. The representatives from the Society on the Advisory Committee are Messrs. Dugald Clerk, F.R.S., Thomas S. Clapham, F. J. West, and H. James Yates.

The Society is fortunate in having secured as its President for the coming year Professor Arthur Smithells, F.R.S., and your Council look forward with confidence to a very successful year under his guidance.

The Society is much indebted to Mr. J. H. Balfour Browne, K.C., who has taken the greatest interest in its welfare, and tenders him its very best thanks for his valuable services and for his able address. The Council are gratified that he has accepted a vice-presidency, and hope to have the benefit of his experience and advice in the future.

The financial position of the Society is satisfactory.

FRED. J. WEST,
Chairman of the Central Council.

The financial statement for the year was next presented, and unanimously passed.

ELECTION OF OFFICERS AND CENTRAL COUNCIL.

The following are the gentlemen elected to hold office during the ensuing year:

PRESIDENT:

Professor ARTHUR SMITHELLS, F.R.S.

VICE-PRESIDENTS:

DUGALD CLERK, F.R.S.
THOMAS NEWBIGGING, M.Inst.C.E.
J. H. BALFOUR BROWNE, K.C.
CHARLES CLARE.

CENTRAL COUNCIL:

Chairman: H. JAMES YATES.
Vice-Chairman: THOMAS S. CLAPHAM.

WILLIAM A. DRAKE	representing	Section I.
HUGH F. WRIGHT	,,	,, II.
W. J. JENKINS	,,	,, III.
J. R. PICKERING	,,	,, IV.
J. WILLIAM GLOVER	,,	,, V.
CYRIL G. DAVIS	,,	,, VI.
F. TEMPLER DEPREE	,,	,, VII.
W. D. HELPS	,,	,, VIII.
H. N. BICKERTON	,,	,, IX.
W. P. GIBBONS	,,	,, X.
B. B. WALLER	,,	,, XI.
JOSEPH TAYLOR	,,	,, XII.

FRED. J. WEST, Elective Member.

CHARLES CLARE, *Honorary Secretary* } *Ex-Officio*
H. M. THORNTON, *Honorary Treasurer* } Members.

Mr. YATES then succeeded Mr. West in the chair, and further business was transacted.

A little later, the PRESIDENT (Professor Arthur Smithells, F.R.S.) took the chair; and the *agenda* was then continued.

Mr. YATES, in introducing the new President, said the Society of British Gas Industries had been particularly fortunate in having had such illustrious men as Presidents in the past. But they had never been more fortunate than on this occasion in having Professor Smithells as the President for the year. He (Mr. Yates) personally looked forward to this year's work with a great deal of pleasure, having a man like Professor Smithells by his side in any case of difficulties when they arose in carrying out the work of the Society. Professor Smithells was particularly adapted to fill the post of President seeing the character of work that had been carried on at the Leeds University; and it was particularly fortunate they should be having their meeting in Leeds, as the members would have an opportunity of inspecting the University the next day, and would thus see the work going on in connection with the Livesey Memorial.

The PRESIDENT acknowledged the kind words the Chairman had used in inducting him into his new office, and he thanked the members for their cordial reception. He then delivered the following address.

PROFESSORS AND PRACTICAL MEN.

It has been a fixed ambition of my life to play a worthy part in adapting education to the needs of the busy world. You will understand then—though I cannot believe you will understand fully—how deeply I feel, and how much I prize, the honour you have done me in placing me in the presidential chair of a Society that consists of men engaged in directing and executing the business of a large and important section of British industry. My position arises, I know, from the circumstance that I have taken part in the establishment of a memorial to that great and noble man, George Livesey, who a short while ago was in your ranks and whose former occupancy of this chair makes it for ever a seat of honour.

I am sure that you will not expect from me more than is reasonable. You know (as, happily, I do also) that any attempt of mine to comment or generalize upon the great majority of the questions that concern you would only lead me to disaster. Your work, I know, is full of anxious problems. The gas industries are in a state of tumultuous development; you do not know what a day may bring forth in the way of changes, great or small. Vigilance, enterprise, skill of all kinds are called for with an insistence that ever increases. It would be grateful to your ears to hear the voice of the true prophet, and to have an unquestionable forecast of your future tasks. Astrology and alchemy were, it is true, kindred pursuits; and it is said that modern chemistry is approaching alchemy. But I will not take upon myself to cast your horoscope.

My predecessors in this chair have, each in his turn, talked to you of the subjects they have made their own; and if I am to come near to them at all, I shall be obliged to talk to you on a subject which, so far as I can judge, everybody has made his own. You can hardly meet the man who is not prepared to talk about "Education." Even if he has had none, he is ready to say how much (or how little) he has missed it, or what it ought to have been if he had had it. It is often said there is no bore like the educational bore. The other day a very good friend of mine—an admirable and humane man—told me roundly he hated the very word education. I can well understand it; but I bespeak your sympathy. If every man you met who used or did not use coal gas was prepared to offer you advice on the construction of a gasholder, you would no doubt suggest (more or less directly) that he might better mind his own business. But we whose business is education cannot do likewise. We have to sit and listen, with what patience we can summon, to every kind of public speaker or writer who chooses to open the floodgates of his eloquence upon us. But I suppose that if people only spoke in public about what they had studied, the hush that would come upon the world would be almost deathly.

I should like to put before you a few of the conclusions to which I have come after occupying for a quarter-of-a-century a professorial chair in an institution which, in large measure, was designed to subserve the educational requirements of industry. At the risk of being thought egotistical, I will explain in the first instance that my father was a railway manager, and that I consequently passed my early life in an atmosphere of strenuous business, where (for mere amusement) I learnt the construction and working of a locomotive, how to manage a signal box, and did a number of other practical things. My first chemical experience was, in fact, in the rather odd work of analyzing the fuel, oils, metals, paints, and other things that pass in and out of the stores department of a railway, while I was still quite ignorant of the science of chemistry. During all this period, I was constantly associated with all kinds of what are called practical men; and the whole burden of that experience was to impress me, when a boy, with the belief that efficiency in the real business of the world bore no perceptible relationship to the processes called education as carried out in schools and colleges. Well-educated men seemed to be men who were interested in reading books in their leisure, or who talked in an interesting way about things outside their business. Sometimes they appeared in the form of mad inventors, whose futile designs were exposed with considerable triumph by my father.

Now I believe this stage of development, or, rather, its opinions are those which, if they would but own it, a vast proportion of the people of this country hold at the present day; and I myself believe that they are not wholly devoid of foundation. It is undeniable that extraordinary practical success is sometimes attainable, in both manufacture and commerce, by men who have had almost nothing of what is conventionally called education; and these men are the hardest facts that we, who preach education, have to reckon with. But I will return to this subject later.

In my own case, after the period I have referred to, I underwent a long University training in this country and abroad, and committed myself eagerly to the academic career which I have since followed. The science of chemistry, as you are well aware, has played an extraordinary part in the development of industry

during last century. There is hardly a branch of manufacture that has been untouched by it; but the most conspicuous example has been the creation of the wonderful industry based on the elaboration of the compounds contained in coal tar. When I was a student in Germany, this industry was in the full tide of development; and I witnessed the continuous flow of the most highly-trained purely scientific chemists from the Universities to the works. I found likewise that, in other industries to which chemistry is applicable, there was a similar demand for scientific brains, and that in Germany as a whole there was a well-established understanding between science and industry very different from anything I knew of in my own country.

You are no doubt familiar with all this; you have heard it before again and again. I repeat it in order to show you how natural it is that English men of science, who have had experience of the system of things in Germany, should be profoundly impressed by its value to the nation. It is not surprising that they should loudly proclaim its excellence and commend it to their own countrymen. Yet it is very easy for people who are imbued by an enthusiasm for something discovered abroad to forget two things—first, that transplantation is sometimes as difficult and as disastrous for political and educational systems as it is for living things. And, again, we are very apt in some circumstances to forget or underrate, the excellencies of our own peculiar possessions. When we are among the snowy peaks of Switzerland, or in the lazy sunshine of a Southern Sea, we may do scant justice to the quiet beauty of an English landscape or to the invigorating spirit of our stormy island shores. I am sure that, among the class to which I belong, there is a danger of under-estimating the deep-seated powers of Englishmen; of neglecting the true genius of our countrymen; and, in short, of falling into a narrow-mindedness which tends to put us out of sympathy with the people we desire to serve. I think that no one who has studied the history of our industrial development, or has moved observantly among our industrial community, can have failed to be impressed by the great native capacity of the Englishman for practical affairs. The quality is one exceedingly difficult to define. It is very elusive; but it is there—this power of doing things—a power compounded of energy, shrewdness, enterprise, determination, sense of the fitness of things, and knowledge of the intuitive kind. Who does not know the man who, somehow or other, can get hold of the right thing; knows a good thing when he sees it; has an unerring sense of a wrong thing; knows when and where to buy a thing, when and where to sell a thing—who, in short, does not know a good craftsman; and where in the world will you find a better than in England? I honestly believe—nowhere. And yet it may be said that a man who is this and no more than this, is but a "serviceable savage." I do not agree. He is a man who has developed one set of faculties; but it is a set by no means to be disparaged, by no neglect to be allowed to rust. I honour the man in his workshop who can tell by the look, the feel, the sense of a thing, what it is good for, as well as I can tell by the light of science from the intellectual eminence of a University. For I know that he is really first rate; in his way, he can assess the value of things for which my science has yet no touchstone. It will be, I dare say, many a long day before an epicure can choose his vintage by chemical analysis; it will certainly be long before science can fully supplant the finely-cultivated instinct of the true practical man.

I trust, therefore, gentlemen, that if I, a mere man of science, take upon myself to talk to you about education in relation to your own pursuits, I do not neglect that vastly important element, of education, that development of "mother wit," which comes to man as he fulfils his appointed task of wrestling in the world with men and things for his survival among the fittest. I am not going to emulate the action of a learned acquaintance of mine, who has recently taken upon himself to lecture the pioneers of aviation, because they have not delayed their heroic enterprise until the mathematicians have discovered the true theory of stability. Scientific men of this kind, if they had their way, seem to be most likely to achieve the true practice of stagnation. I do not bid you cease to lay mains, to erect gasholders, and to make gas-fires, till we (in the august seclusion of our learned halls) have worked out the whole true science of heating and illumination.

But while conceding all this, we have to remember that it is man's prerogative (and it should be his delight) to possess, to use, and to extend the faculty of reason; to increase his power over the forces of Nature, and to constrain them to his service by a deliberate, a carefully organized, and an unceasing cultivation of the human mind.

The true barbarian is the man who is content to do, and does not want to know. And yet how many men are there not, whom no one could call barbarians, who look upon our organized system of education with a degree of disgust that increases in intensity as their survey passes upwards from the Elementary School to the University? This, in my judgment, is a most serious question of the day.

I have long held the opinion that education in England is afflicted, from top to bottom, with an utterly exaggerated fear of what is called "useful knowledge." In that fear much of a vital kind has been left undone, and much has been given in the name of education which helps its possessor neither to truer wisdom, better work, nobler conduct, nor to greater happiness. The world cries out for educational bread, and it receives only too often an academic stone.

I do not know that I am behind other men in the delight I feel in abstract studies; and I can honestly say it is but rarely I envy another man his larger share of loaves and fishes. But knowledge gathered for what is sometimes called its own sake, and treasured for its own sake, seems to me in great danger of unwholesomeness; and a learned man who is merely a man of erudition, is as likely to prove a mischief as he is certain to be a bore.

At the head of our educational system stand the Universities. A University is (or should be), in essence, a mine and a mart for the highest learning. It was in its origin an adjunct to those callings which made the greatest demand upon the powers of thought. You may put it more picturesquely, no doubt, but it suits my purpose best to use homely terms; for I believe too little stress has been placed upon the real beginning, and the original purpose, of Universities, as institutions standing in direct relationship to definite callings. It is, I believe, because our University system has not kept pace with the great changes that have taken place in the character of human occupations that Universities have failed to secure, or to retain, the sympathy of a large section of the community. The great delay in the development of research and of instruction in Natural Science in the Universities led to a corresponding delay in the dissemination of elementary scientific knowledge through our schools; and, in consequence, we find to-day in the older generation of our more educated citizens—to say nothing of the less educated ones—a whole legion of men whose knowledge of science would not correspond in terms of their grammar to knowing the difference between a noun and an adjective, in their geography the difference between latitude and longitude, and in their Latin to that between Cicero and Cæsar. Now I lay great stress upon this lack of the general dissemination of scientific knowledge, because people sometimes say to me that, after all, we have surely had many distinguished men of science in our Universities for generations past. It is true. But they were not preparing a market for their wares; they were elaborating in their seclusion something which was utterly mysterious to the average man. Even to-day people come occasionally into my laboratory with the air of men entering a "hall of mystery" or a "chamber of horrors," fearful of what may befall them. Again, people say to me, surely the industrial fruits of scientific knowledge have long been recognized? True again, most palpably true; but how the fruit is related to the knowledge, how the seed is sown, how it is tended, what should be done to nurture the plant, that is not known. It is not known because your educational system did not achieve this one thing for the community—it did not put its victims for a single occasion in their lives in the position of asking a simple scientific question, and of faithfully finding the answer by experiment.

Now the portion of knowledge which most completely and most vitally interpenetrates our manufactures is Natural Science; and it has been, I think, an incalculable disadvantage that while these manufactures were advancing by leaps and bounds during the century succeeding the industrial revolution (which I suppose may be dated about 1760), there was no movement in the educational world for a general dissemination of scientific knowledge and skill. During this period, several misconceptions took deep root in the English mind. The achievements of Arkwright the barber, Hargreaves the weaver, Crompton the farmer, Watt the instrument maker, Cartwright the clergyman, Stephenson the fireman, Murdoch the millwright, and of all that illustrious group—their great and fundamental achievements created an overwhelming belief that the self-taught inventor was destined to be the only important pioneer in industrial discovery; and to this day a young man brought up on a diet of grammar and Samuel Smiles might well despair of contributing anything of moment to the service of industry, unless indeed he happened to be exceptionally poor and to have attended no more showy a place of education than a Night School.

If the Universities had set themselves to send a current of science through our schools at the time when the direct utility of scientific knowledge and of scientific method was becoming demonstrable in the industrial world, we should, I think, be in a very different position to-day, and our Universities would hold a very different place in the esteem of our countrymen. It is this historical retrospect, and the experience of the frantic and wasteful struggles in my own lifetime on the part of the worker to come to terms with the thinker, that have made me realize the dangers that attend academic seclusion, and have left me well content that my lot as a University teacher is cast within earshot of the throb and hum of busy workshops.

Of all that we have lost in the course of the events I have described, nothing is more difficult to retrieve than confidence in the practical usefulness of University science. We are suspected at every turn of trying to elude the practical man, and to betake ourselves to studies, and impart information, whose glory lies in its detachment from all things mundane and remunerative. We have engendered the suspicion that we are intellectually exclusive, and that we do not understand or sympathize with the practical point of view. A better understanding between us is, I think, a matter of the greatest national importance; and it has seemed to me that if a better understanding is to be attained, it is incumbent on the Universities to go out as far as ever they can to meet the legitimate claims of the industrial community, and to bring their studies deliberately into the closest possible relationship with the industrial arts.

I think I may claim that in this University we have shown no lack of courage in doing so. In spite of a good deal of academic apprehension and distrust (not always kindly expressed) from

outside critics, we have established departments of work for the explicit purpose of furthering the special pursuits of the industry, much in the same way and in the same spirit as schools of law, medicine, and theology were established in byegone days. Another thing on which I would lay the greatest stress, is that we have secured in the direction of our University as a whole, and of these special departments in particular, the active co-operation of men of business and of representatives of the particular industries concerned.

I do not look upon these steps as a gracious concession, still less as a sordid opportunism. I believe that they secure the best interests of thought as surely as I hope they will serve the most immediate needs of work.

No one who has studied the history of science can be ignorant of the fact that science has its roots and has gained its greatest impulse in the practical avocations of mankind. Chemistry was born in foundries and pharmacies, and nearly every great advance can be traced to some industrial impulse. I suppose the greatest achievements in chemistry were those of Lavoisier. How did they arise? I believe I am not wrong in saying that it was in the preparation of his prize essay on the best mode of lighting the streets of Paris. Beginning with a consideration of the best form of lamp, the most effective form of reflector, the most suitable shape of oil-container, Lavoisier passed to the study of combustion, and, finding organic things like oil and tallow too complex to reveal the fundamental nature of the process, he betook himself to simpler things like phosphorus and zinc; and so he was led to the train of discoveries which constitute the foundations of modern chemistry. "It was," as M. le Chatelier has said, "this constant preoccupation with practical questions that enabled Lavoisier to escape without effort from the fictions and conventions amid which contemporary chemists were merely marking-time."

I have given you but one of innumerable examples to illustrate a truth that we who profess science should never be permitted to forget, and to assure you that I regard the close association of Universities with the business world as of enormous advantage to the Universities. We have in this, I believe, the true corrective of academic excesses, the best stay for academic frailties; and I believe the good understanding and mutual respect which we may hope to bring about between the leaders in the spheres of labour and of learning will extend rapidly through the rank and file.

I hope you will find in what I have so far said, the evidence of a desire to acknowledge some of the shortcomings of the academic world. But I might well be suspected of having had my head turned by the dignity you have conferred upon me if I left you under the impression that I thought the faults were wholly on one side. In what remains of the time at my disposal, I wish to confide in you some of the difficulties of the situation which arise from the other side.

I believe that a very large number of business men go wrong when they enter upon the consideration or criticism of educational affairs by attempting to apply methods and standards and principles borrowed from their own callings, which, however excellent in their proper place, do not apply (or at least do not apply in the same way) to education. Let me remind you in the very first place that you can, for example, prepare no balance-sheet of a University. You know how much money comes into the University chest and how much is paid out; but how much a University costs, or how much it earns, no man can discover. Suppose, for example, in my zeal to find employment for a student, I send you a young chemist, who, (by his unrestrained ardour or incompetence) misleads you into all kinds of futile extravagance—surely you would debit that to the University? I do not doubt you would; every care is taken that such things are brought home to us. Suppose, on the other hand, that I send you some one (like a former student I met last week) who, by what he had learned here, increased the output of his employer's business by 33 per cent. Should this not be credited to the University?—if by someone's indiscretion you happened to hear of it? I think so. In a business like ours, it transcends the powers of any accountant to effect an audit; you would need a whole secret service of educated spies. You, individually, may give us a thousand pounds in the hope of a return; but you, individually, may get nothing in return—at least in this world—or you may get a return that you cannot trace to its source. No; the essence of University finance is collective investment. It is to some considerable extent selective for a locality, and may be made equally so for a single group of interests or industries. But looking at a University as a whole, it is national or even international in its financial ramifications.

If I and many of my colleagues in this and other Universities are of some value to this country, I would have you remember that the cost of our education has, to a quite considerable extent, fallen upon the German taxpayer.

If I say that the students who have gone from our Chemical Department are collectively earning half-a-million a year for the firms who employ them, no one can contradict me; and I am tempted to affirm it positively as a counterblast to those hasty financiers who look at our accounts and raise their voice in lamentation over the capital we lay down, without ever stopping to think of the unrecorded dividends that accrue.

I will take another thing. I think a good business man, while anxious to progress and branch out, while ready to take risks and go somewhat afield for promising expedients or appliances, is usually very careful not to lose sight of the main current of his affairs—expecting to profit by deliberate, methodical plans rather than by totally unexpected accidents. The same is doubtless true within the pursuit of science itself where the object is simply to elucidate a given problem. But when it comes to the contact between science and industry, an entirely new factor appears.

The discovery of the atmospheric burner was not an accident. It arose from the desire of Bunsen to have a gas-flame that would not smoke his flasks; and it was contrived by a stroke of genius. But what an accident for you that a man of genius should want a smokeless flame! When I was a student in Bunsen's laboratory, there came to it Carl Auer von Welsbach, in the spirit of an unalloyed philosopher, eager to solve some problems about the group of chemical elements that seemed (of all) the most remote from any daily human needs. He noticed the remarkable glow of the mixed oxides when a flame impinged upon them. And so he begat the gas-mantle. Again I say, no accident for him, but again what an accident for you, that a man of genius should want to investigate the mystery of rare earths!

I need not ask you where the gas industry would be to-day without these "windfalls from the tree" of scientific knowledge, whose branches, be it remembered, wave most vigorously in the upper air. Instead of in this assembly of comfortable gentlemen, enduring so kindly the garrulity of a professor, you might perchance have been found in Trafalgar Square listening, under the banner of the unemployed, to more moving eloquence.

By what definite planning are you to get discoveries of this kind made? The answer is, I think, by treasuring your men of genius, and letting them work in the light of their genius. Surely the time has gone by to wonder whether true scientific work, carried on in the spirit of a philosopher, by a man of genius with his feet upon the earth, subserves the material needs of humanity. Who is there that will dare to set his finger on any patch of new natural knowledge and say: "This may be edifying, but it is nothing to us?"

When, therefore, you seek to bring science into your service, beware of unduly fettering the minds and discriminating the topics. This seems to be the hardest lesson of all for the Englishman to learn. His very straightforwardness and stern common sense, and his businesslike ways, may all conspire to make him unbusinesslike in matters of education and research, to which, believe me, a man must serve a long apprenticeship before he becomes a master craftsman. I will listen eagerly to a business man while he tells me what he wants; I will eagerly seek the real knowledge that he has to give; I will eagerly lean upon him in the manifold business of administration; I will eagerly take his money. But when he wants to tell me that I shall teach this and not teach that; that this is useful, the other useless; above all, when he talks as if a well-constituted University should give proficiency in the practice of trades and render apprenticeship superfluous—well I do not listen to him very patiently, and I say to myself, "Alas that this man should think himself practical!"

If we on our side come to take a more sympathetic and direct part in bringing science to your service, I plead that you on yours shall show a larger measure of faith, of hope, and I might almost say of charity. Do not try to constrain us in our own proper business; do not be impatient of returns. They are sure to come—history has abundantly proved it; but you must freely cast your bread upon the waters.

I have chosen in this address to take what may be called a materialistic view of education, and I am not ashamed. I do not forget that education has many purposes to serve, and that man does not live by bread alone. But without bread man becomes a shadowy or a rebellious being; an ascetic or an anarchist. He must have bread, and he must get it by the sweat of his brow. Englishmen collectively must have work; the nation must have industries; and I take it as no degradation of education to contrive that it shall minister directly to their preservation, their progress, and their prosperity. Rather would I say this—that thereby you dignify labour, refresh the toiler with the fruits of knowledge, and infuse into his daily work the delight of seeing beneath its grime and dust a play of stupendous forces within majestic laws.

Of all the men whom I have known, I could point to no one who more completely than George Livesey embodied the finest native strength of the English industrialist. He was one of those men to whom I referred at the beginning of this address, who was bound to succeed independently of all that we call formal education. But you know that he never breathed any such vulgar boast. On the contrary, he believed with all his heart in the worth of all things intellectual. He was eager to draw to his aid all the resources of modern science; he took the broadest, most sympathetic, view of scientific research; and I can, as I have said before, imagine no memorial more acceptable to him than the one which to our great honour you have set up in this University. In the inspiring address which he delivered to you from this chair three years ago, he lifted your thoughts to the ethical side of industrial life, and preached to you the chivalry which you know he had practised in his life. Honest dealing, confidence between man and man, care for the workman, national before personal interests—in short, a large hearted humanity—these were his topics as they were his qualities. I am not without hope that in the Universities old and new, where knowledge should be cultivated, whatever it may pertain to in the worship of truth, where young men should see visions, we may help to maintain the fine flower of British industry, of which George Livesey was so splendid an example.

At the close of the address,

Mr. YATES remarked that they had all listened to Professor

Smithell's address with great interest and pleasure. There was no one in the position to address the members on the subject he had dealt with like their President had done. He had a happy way of combining his special knowledge with the everyday requirements of manufacture. It had often been said that in England they had not realized what science could do for them. He was glad to say this reproach no longer existed. They were all now applying science to their industries; and but for the help of the Universities, they would not be in the position to apply it. It was a reproach that Germany had studied the scientific side of their work far more than had been done in this country. But it was to him a great pleasure to hear Professor Smithells say there were no men better than Englishmen when they set out to do a thing. He moved a very hearty vote of thanks to their President for his address.

Mr. A. P. Main seconded the motion. It must, he said, have been to them all a pure and unalloyed delight to listen to the chaste language in which the claims of true education had been presented to them that day by their President. He had given them much to think about; and he had indicated the position of the University in relation to industry. The Glasgow University was proud of the fact that, when the Associated Trades expelled James Watts, the University sheltered him, and provided a workshop for him. There was nothing more, he was sure, that they need say, except to express their gratitude for the address, which would cause them all to think for many a day to come.

The motion was enthusiastically carried.

The President, in reply, said he was grateful to the members for the cordial acknowledgment of the words he had put before them. He would not say more just now; but he was sorry that he forgot at the outset to say, on behalf of every member of the University, how very warmly they welcomed the members within its walls. When the meeting was mooted, the University authorities were proud to think it was going to be held in Leeds. By coming within the University walls for their meeting, they gave point to some of the sentiments he had ventured to put before the members—the friendly relation between Science and Industry.

Mr. Thomas G. Marsh then read a paper, entitled "The Gas Industry: A Retrospect and a Forecast"—see pp. 687-90.

Vote of Thanks to the Leeds University.

Mr. Yates, as Chairman of the Council of the Society, moved a vote of thanks to the authorities of the University for their hospitality, and for allowing them the use of the beautiful hall in which they were assembled. The members were deeply grateful to them.

There was very hearty endorsement; and this concluded the business proceedings.

THE DINNER.

The members at once repaired to the Great Northern Hotel, where a little later they, with guests, in all numbering probably 130, had dinner, with the President (Professor Arthur Smithells) in the chair. The Civic and University authorities were well represented. There were the Lord Mayor of Leeds (Alderman Middlebrook, M.P.), Alderman Penrose Green, J.P., Chairman of the Gas Committee, Mr. Robert Armitage, M.P., Mr. Arthur G. Lupton, J.P., LL.D., Pro-Chancellor of the University, Alderman Chas. F. Tetley, M.A., Chairman of the Livesey Advisory Committee, and Professors Bone, Bragg, and Cohen were also of the guests. Mr. Alexander Wilson, President of the Institution of Gas Engineers, and Mr. R. G. Shadbolt, Vice-President, were there. Mr. Dugald Clerk, F.R.S., Mr. Charles Wood, Mr. Robert Watson (President of the Manchester Institution of Gas Engineers), Mr. J. Gilchrist, Mr. J. W. Morrison, Mr. R. H. Townsley (Engineer and General Manager of the Leeds Corporation Gas Department), and Mr. C. E. Brackenbury were observed. The Vice-Chairmen were Mr. H. J. Yates (Chairman of the Council of the Society), Mr. F. J. West, Mr. Thos. G. Marsh, Mr. W. D. Helps, Mr. Thos. S. Clapham (Vice-Chairman of the Council of the Society), Mr. H. M. Thornton, and Mr. W. A. Drake. After dinner, several toasts engaged attention; and excellent music and songs by lady and gentlemen artistes diversified the interesting proceedings.

We cannot do more than extract a few points from the several speeches.

Mr. Dugald Clerk, F.R.S., proposed the toast of "The City and University of Leeds." He remarked that it was fitting that a Past-President of the Society should, on their first visit to Leeds as a body, express to the Lord Mayor and the University authorities the feelings of the members upon the great work the City and the University were doing in the world. Apart from his connection with the Society, he had a personal interest in Leeds; for this was the first English town in which he resided after leaving Scotland. That was about 37 years ago when the Yorkshire College of Science was founded; and he was the first appointed Assistant. The University was the outcome of this College. He referred to names famous in science and industry that were associated with the history of Leeds. The address that their President had given them that day traced the relationship of the work of the purely scientific man with that of the purely technical man. It was quite possible to be a scientific man and a practical man at the same time; and this the address of the President had made abundantly clear to them. Then came the work of the modern Universities, such as Leeds, Manchester, Liverpool, and Birmingham, which represented a great and new movement for the supply of men educated specially for service in the industries of the country. These Universities—and Leeds stood in the forefront—devoted themselves as much to practical science as to abstract science. The Professors of these new Universities saw what many of the Professors of the old Universities did not see, and that was the many scientific problems that arose in the everyday work of industry. Their President had devoted himself largely to the study of the physical structure of flame; and Professor Bone had done much work on chemical combustion. They all hoped that, through the Livesey Memorial, there would be much work done that would have great practical value. The University had indeed shown them the way of coupling industry with science.

The Lord Mayor, in his reply, said as the Chairman of the Gas Committee and the Pro-Chancellor of the University were also to respond, there was not much for him to say. But he thought he could claim the applause of those present for the Leeds City Council for their interest in the work in which the members of the Society were concerned. When the suggestion of a Professorship in Fuel and Gas Engineering was originally made to Sir George Livesey, the first question he asked was, What would Leeds do? When he heard of the encouragement the Leeds City Council gave to the establishment of the professorship, the question was answered; and Sir George was influenced to generous action. As to their city gas affairs, an undertaking in which there was a capital of something like 1¼ millions sterling, surely provided a field for the industries represented on this occasion; and when he said they had mains sufficient to supply gas from Land's End to John o' Groats, with a few hundred miles to spare, there again would be recognized scope for their industries, and that scope was not by any means exhausted. Take, for example, the stoves connected. They had one stove connected for every fifth house in the city, leaving four houses out of five as a fruitful field for industry in the future. The Chairman of the Gas Committee was to be congratulated upon the fact that, under the able management of the department, while giving a supply of gas at reasonable prices, he was able to show a gross profit amounting to nearly £100,000 a year.

Alderman Penrose-Green, Chairman of the Corporation Gas Committee, in the course of his response, gave further particulars regarding the Gas Department. He said the capital expenditure stood at nearly £2,000,000; but they had repaid some £600,000 out of the revenue. They had a revenue of about £400,000 a year; and they paid in wages about £100,000. They carbonized the substantial amount of coal of about 300,000 tons per annum. They had in use no less than 47,000 prepayment meters, 116,000 of the ordinary type, and about 17,000 stoves; and these were supplied through nearly 1000 miles of mains. Work was provided for 1200 men. Strange to say, the consumption of gas had been reduced by about 1 per cent. since 1905; but this was no doubt on account of the competition of the electric light and the improvement in incandescent gas-burners. The Gas Committee had been giving careful consideration to this reduction of consumption; and they were deliberating at the present time whether they could not increase the facilities, so that gas could be used to a greater extent for domestic and manufacturing purposes. It was quite possible, in his opinion, by differentiating the price, to increase the output, so that there would be no reduction in the amount of the profit. In regard to the works, they were considering whether it would not be possible to discard some of the old retort plant, and go in for a still more modern system—vertical or some other kind of retorts. He felt sure that the Livesey Memorial would be the means of bringing greater knowledge to bear on the manufacture and utilization of gas.

Mr. Arthur G. Lupton, Pro-Chancellor of the University, claimed it as a great credit to the business men of Leeds that 35 years ago they concluded that, for their purposes, there was something more wanted in the way of education than merely the three r's. It was very remarkable how from small beginnings their University had grown to its present dimensions; and this was owing to the importance that the heads of industries were now attaching to scientific training. He believed that even now the University of Leeds was only in its early stages, and that it had a great future before it. One sign of this was that the gas industry had founded a professorship there; and they had held their meeting that day in the building with which the professorship was associated. In the name of the University he expressed the hearty welcome of the authorities.

Alderman Tetley, M.A., Chairman of the Livesey Advisory Committee, proposed "The Society of British Gas Industries." He remarked that he had been Chairman of the Corporation Gas Committee, and was now Chairman of the Tramways and Electricity Committee; and he could see no reason why there should be quarrelling between gas and electricity. He could not see the use of hysterics on either side, regarding it as a sign of mischievous imbecility. He thought the time would come when municipalities that had embarked on these enterprises would find it advisable to separate the work of the two Committees, and assign to each work in its own proper place. He did not see why this should not be done with perfect friendliness between the two departments. It must, however, be on the terms that capital and plant were fully employed, and there should be no favouritism. In the course of further remarks, he referred to the death of Mr. John Bray, who, he said, was a man of keen intellect like his father. He was at once scientific and practical; and he above all others in their midst knew the great value of research, and was willing to back his opinion. It could only be hoped that the traditions he had left to the firm he had departed from and to the University and the department he helped so well, would be a source of inspiration to those he left behind. As to the future of the gas industry, they all looked to gentlemen such as the members of the Society to help to advance this future. He especially looked hopefully to the part the gas-fire would play in the future; and in regard to the manufacture of gas, he looked to the time when gas would be purified in closed vessels with a liquid medium. He hoped in this direction experiments would be eventually thoroughly successful. He wanted to see the gas led carefully and pleasantly along from retort to holder, without passing through vessels that required special attention or manual labour. He also referred to a deputation appointed by the Corporation for the purpose of visiting the Continent to inquire into carbonizing systems.

The President, in the course of his reply, said he thought their Society showed how men who were rivals in business could meet together and exchange information and knowledge with one another, without the sacrifice of their own particular interests, and yet to the

great advantage of the whole body collectively. There had been far too much timidity in this country, and far too much isolation. In the industries of iron and steel, they had had an enormous national gain through the representatives meeting together, and exchanging ideas. He felt perfectly sure the Society would play a good part in the future of the gas industry.

Mr. H. M. THORNTON proposed the "Institution of Gas Engineers and Kindred Associations." He observed that the toast was one which had often been given enthusiastically before; but it had never been given in the past, nor would it be in the future, with more sincerity and more cordiality than on this occasion. He referred to the financial position of the gas industry, to its stability, and to the firmness shown by the investment in it during the past twenty years. In wishing prosperity to the Institution and Kindred Associations, he alluded to the work that had been done by the co-operation of these bodies and the Society in many ways—one of which was the Livesey Memorial. The Society also intended to associate itself with the work of the Publicity Committee. He was glad to see the Institution taking its rightful place in educating the consumers how to use gas properly for both domestic and manufacturing purposes. The Society should encourage all their members to contribute to the fund; for the work that it would do would be in the interests of the whole industry, and not of merely a part. Advertising took more forms than one; and he would suggest as part of the work of the Publicity Committee that they should take large industrial centres, with extensive outer districts, and arrange for a comprehensive exhibition to visit each centre for a period. He coupled with the toast the names of Mr. Alexander Wilson (the President of the Institution) and Mr. Robert Watson (the President of the Manchester Institution).

Mr. ALEX. WILSON, in responding, said he was sure the members of the Institution would appreciate very much this invitation to their President. The closer the Institution and the Society came together, the greater, in his opinion, must be the advantage not only to the manufacturers, but to the industry generally throughout the United Kingdom. He was as pleased as Professors Smithells and Bone that the Livesey Memorial had been centred in the Leeds University. The University had laid itself out specially to deal with practical work of this kind; and they were all looking forward to an immense amount of good to the gas industry from the work accomplished at the University. They were looking forward to the time when the scientific-practical man would come to the front in their industry; and when this time came, they might anticipate that things would go along at a faster rate. With regard to competition, the more of fair competition they had, the better for everybody; and, in this connection, there were a few words he should like to say that bore on the work of the Gas Publicity Committee. It had been said by one of the previous speakers that in Leeds they had one gas-stove fixed to every five houses. Well, part of the work they had before them was to get stoves into the other four houses; and they wanted to get gas-fires and water-heating appliances into the whole of the five houses. In the opinion of gas men, gas offered the only practical and economical way of doing the work of heating at the present time. The reason there were comparatively few appliances in dwellings at the present time was because of the ignorance of people; and in dispelling this the Publicity Committee were hoping to take part. He commended the scheme to the hearty support of all. In the North, they recognized that this work should be carried out. Gas fires and stoves had done much for the atmosphere of London. Why could not the same thing be done in Leeds, Manchester, Birmingham, Glasgow, and elsewhere? From what he had seen of the atmosphere of Leeds, he felt the city was quite as much in need as Glasgow of something being done to improve its state.

Mr. ROBERT WATSON responded for Kindred Associations. He also spoke of the happy results of the co-operation between the Institution, the District Associations, and the Society.

Mr. W. D. HELPS proposed "The Visitors," and Mr. ROBERT ARMITAGE, M.P., replied. In the course of his concluding remarks, he mentioned that he had had a great deal to do with producer gas; and there he had been faced with the question of purifying the gas from sulphur. If only some method could be invented for purifying large volumes of gas from sulphur, it would be of enormous benefit to the users of producer gas.

With the singing of "Auld Lang Syne," a happy evening was brought to a close.

Visit to the University.

The following morning the members of the Society and their guests paid a visit to the University, where they were received by Professor Smithells, Professor Bone, Professor Cohen, and in the various departments visited by the respective heads. Later Alderman C. F. Tetley, the Chairman of the Livesey Advisory Committee, and the Pro-Chancellor of the University (Mr. A. G. Lupton, LL.D.) joined the party. There was so much of interest to be seen in the vast establishment, that only a few departments could be inspected. It was observed how thoroughly the University by their methods impress upon the students the correlation of science and practice. The engineering department (civil, mechanical, and electrical) was first inspected; and then the vast section—replete with machinery of all kinds, and wonderfully constructed—of the textile industries was examined. Introduction was made to the large laboratories in which work—educational and research—in tinctorial chemistry and dyeing proceeds. Then the department devoted to the leather industry was inspected—in all science and practice being amalgamated in the instruction given, but in no case does the University claim that the work done displaces the necessity for the training that can only be procured in the factory. Then the visitors came to the mining department; and from there they ascended to the laboratories of the Fuel and Gas Engineering Department, where Professor Bone took them in hand. Here was the centre of greatest immediate interest to the visitors. We need not describe the equipment of the laboratories. It has already been done in our pages; but the inspection impressed all with the immense potential capacity of the department for laying among the future technical officers of the gas industry the scientific foundation that has become more and more essential as the processes and applications of gas have broadened. There was one special object of interest on view, appertaining to the development of gaseous heating, which had an immense attraction for the visitors; but we have transferred reference to this to our editorial columns. It was a morning of supreme interest, and not one of the visitors felt that the time had been ill-spent. And to Professor Smithells and Professor Bone they personally expressed their gratification with all that was seen.

The visitors were afterwards invited to the University refectory, where they were kindly entertained to luncheon by the University authorities. The Chairman of the Livesey Advisory Committee (Alderman Tetley) presided; and he was supported, among others, by the Pro-Chancellor, and the President of the Society (Professor Smithells).

After luncheon, the order was no speeches; but

Mr. ALEX. WILSON, President of the Institution of Gas Engineers, said he did not think the company could break up without rendering their thanks to the University authorities for the treat given that day to the visitors in being allowed to inspect so many of the departments, and for the hospitality that had been extended to them. There had been the greatest interest in going round the various departments, and observing how thoroughly the great work was being carried on in the place; and the success that they had seen in each department augured well for the section devoted to the gas industry. There had been a conference of the Livesey Advisory Committee on the methods to be adopted in promoting the attendance of pupils in the department. The advantages were so great that it would never do to allow them to run to waste. The utmost advantage must be taken of the opportunity, or the gas industry would be the sufferer.

The thanks of those present were heartily accorded.

Alderman TETLEY, in reply, said that, as one who had been associated with the University for a greater number of years than he cared to think of, he did indeed rejoice in the opportunity they had been able to give those present of seeing what was done there, and how it was done. They had had their struggles. They started as a College of Science; and certain of the members of the Council tried to keep it severely as a College of Science. In fact, some of the members of the Council thought they were a mere Technical School, and that they ought not to rise higher than give scraps of elementary knowledge. But they had risen far beyond that; and with the help of the members of the gas industry, they hoped to make the Gas Department as successful as the other departments. All the departments, with few exceptions, had begun in a very small way; and he was glad that they had been able to do so much since, in spite of small beginnings. By the aid of the gas industry, they would be able to make its department a great success; and it would assist in showing that the industry was by no means played out.

With adieus to their hosts, the members left the University; thus ending one of the most enjoyable meetings the Society has yet held.

MANCHESTER UNIVERSITY LECTURES.

Dr. J. A. Harker on Pyrometry.

The sixth and last lecture of the series arranged to be given in the Manchester University, under the scheme formulated by the Manchester and District Junior Gas Association, and supported by the Manchester District Institution, was delivered on Saturday afternoon by Dr. J. A. Harker, F.R.S., head of the Thermometry Division of the National Physical Laboratory, who took for his subject "The Measurement of High Temperatures." Professor Harold B. Dixon, F.R.S., had been announced to preside; but he found himself unable to be present owing to other engagements, and his place was taken by Mr. John Bond, the Gas Engineer to the Southport Corporation. There was again a large attendance of members of the Junior Association; and the District Institution were represented by Mr. H. Kendrick (Stretford), Mr. S. Meunier (Stockport), and Mr. T. Banbury Ball (Rochdale).

The Chairman briefly introduced Dr. Harker, who proceeded to deliver his lecture, which consisted of a description, illustrated by lantern views, of the newest forms of pyrometric apparatus in actual use. Unfortunately, he was unable to complete the notes of his lecture in time for publication in to-day's issue of the "JOURNAL;" but he hopes to be able to do so in the course of the present week. At the close of the lecture, a vote of thanks was accorded to Dr. Harker, on the motion of Mr. T. Banbury Ball, seconded by Mr. C. Woodhead, a member of the Council of the Junior Association. Dr. Harker, in acknowledging the vote, said they were all much indebted to the Cambridge Scientific Instrument Company, Limited, for having sent down, for the purposes of the lecture, so many specimens of their work, and also their representative to explain the details of the instruments exhibited and in use.

The thanks of the meeting having been given to Mr. Bond for presiding, Mr. A. L. Holton, the President-Elect of the Junior Association, moved what he described as "an omnibus resolution"—this lecture being the last of the series. He said that at the commencement of the lectures their thanks were voiced to those who had helped them in the matter; and seeing that the lectures had been so successful right away through, they desired to put another resolution on record, to the effect that the Council of the Junior Gas Association convey the thanks of the members to the various parties who had assisted in carrying out the scheme.

First, the Senate of the Manchester University, with special reference to the help and advice given by the Vice-Chancellor and Professor Dixon; then the Council of the Institution of Gas Engineers, the members of which had looked with favour upon the movement; and lastly to the Manchester Institution, especially Mr. Kendrick and Mr. Meunier, for the valuable help and assistance given by them to the scheme.

Mr. J. Taylor (Mossley), in seconding the proposition, said he wished particularly to call attention to the work done in connection with these lectures by Mr. Thorp, to whose initiative the lectures were really due. Mr. Thorp had been ably backed by the District Institution, particularly by Mr. Kendrick and Mr. Meunier, who had done good service and been regular attendants at the lectures, the very high standard of which must appeal to them all. He was inclined to the opinion that such a course of lectures on gas engineering subjects had never before been presented in a syllabus in this country. He thought it was an indication of the educational acquirements which were now looked for from gas engineers; and he hoped that in the next session they would be able to have lectures of a similar type.

The resolution was carried, and this concluded the proceedings.

THE PROPERTIES OF AMMONIUM SULPHATE.

Among the papers read at the meeting of the London Section of the Society of Chemical Industry held at the Chemical Society's Rooms at Burlington House on Monday, the 20th ult., with Mr. E. Grant Hooper, F.I.C., in the chair, were two by Mr. Watson Smith, F.I.C., the Editor of the Society's "Journal." The first paper was on "Ammonium Sulphate and its Instability;" the second on "The Hydrolysis of Ammonium Salts."

The author referred in his first paper to contributions which he had made to the Society's Proceedings in 1895 and 1896, on "Some Reactions of Ammonium Salts," and the "Comparative Affinities in the Case of Certain Salts of Ammonium, Sodium, &c." In one of these papers, he pointed out that ammonium sulphate $(NH_4)_2\,SO_4$, would not melt, and that, on heating it, one equivalent of ammonia was expelled and ammonium hydrogen sulphate NH_4HSO_4 (or bisulphate, or acid sulphate, of ammonia), was left. It was pointed out also that Gmelin's Handbook of Chemistry ascribed to ammonium sulphate a melting point of 140° C. The salt was also said to commence decomposition above 280° C., and to begin subliming at this temperature. The facts, however, are that ammonium sulphate has no melting point—that it begins to decompose with loss of ammonia at temperatures below 100° C., and this decomposition becomes complete at 300° C., when fusion of the residue takes place. The salt cannot be sublimed. The residue is the acid sulphate; and it is this salt which melts at 140° C. and decomposes under ordinary pressure at a higher temperature with sublimation of ammonium sulphite. When under reduced pressure, the acid sulphate can be sublimed.

The statement that the normal sulphate melts at 140° C., and is sublimed at a higher temperature, has been perpetuated in nearly all the standard text-books and dictionaries of chemistry from Gmelin's time onward. The author investigated the origin of the erroneous statement, and found that Gmelin had taken it from an article by R. F. Marchand, which dealt with the behaviour of glass towards ammonium sulphate. But Marchand was, in fact, dealing with the acid sulphate; and the statements were transferred to the normal sulphate through confusion on the part of a translator from the German eighty years ago. The wonder is that so profound an error relating to a salt of such great importance technically and commercially as ammonium sulphate should not have been corrected sooner, or at least not have been corrected in most of the standard works of reference. Some of the American text-books appear to have recognized the error, and Berzelius in 1837 stated the correct facts. But his statement has been overlooked by later authors.

The second paper, which referred to the hydrolytic dissociation of ammonium salts in aqueous solution, was also based on earlier observations of the author. He referred to the experiments of Debbits, who found that on distilling ammonium chloride ammonia escaped, but was accompanied by slight traces of hydrochloric acid; while after a time the acid began to predominate in the vapours, and the residue yielded an acid solution. On adding water to the residue and repeating the distillation, the same phenomena occurred again. Naumann and Rücker contradicted Debbits's observations. Debbits examined the chloride, nitrate, and acetate, and found that solutions of all of them liberated ammonia when boiled, and also when hydrogen was passed through them. It appears that the inert gas causes liberation of the constituent of the salt which is volatile at the lowest temperature. When ammonium sulphate is heated and steam is passed through, almost pure ammonia is evolved; but if the passage of steam is stopped, vapours of ammonium sulphite occur. In 1905, V. H. Veley investigated the hydrolysis of ammonium salts, and showed that, in regard to the nitrate and sulphate, hydrolysis was dependent upon the dilution of the solution. On the other hand, hydrolysis was *nil* or inappreciable with the bromide and chloride.

As a result of his investigation of the subject, the author recommended that direct titration of ammonia should be made with hydrochloric acid, and not with sulphuric acid, because of the hydrolysis occurring with the sulphate. In reference to other analytical work, the author pointed out that in 1909 J. Hendrick had found that in determinations of the amount of lime in basic slag by distillation with ammonium sulphate a greater amount of ammonia was obtained than when the slag was distilled with ammonium chloride. He said that this greater proportion of ammonia was probably due to the lime being largely present in the slag in the form of silicates; and sulphuric acid decomposed these silicates more effectively than hydrochloric acid. The author pointed out that, as a fact, however, the increased yield of ammonia was due simply to hydrolytic dissociation of the ammonium sulphate.

Dr. V. H. Veley opened the discussion which followed the reading of the two papers. He stated that, in his investigations in 1905 on "The Hydrolysis of Ammonium Salts," the solutions were boiled in a flask fitted with a reflux condenser so as to obtain equilibrium of ammonia in the liquid and vapour. He had found that ammonium sulphate was hydrolyzed much more than ammonium chloride, and the ammonium salts of organic acids much more than the ammonium salts of inorganic acids. The order in which they suffered hydrolysis was practically that of the chemical affinity of the acids with which the ammonia was combined.

Dr. Lewkowitsch stated that organic acids were easily decomposed when combined with ammonia, so that the preparation of the acids in the form of ammonium salts was not to be recommended. For instance, the oleate and cerate of ammonia lost ammonia at ordinary temperatures, and continued to lose it until the acid salt remained.

Mr. G. Nevill Huntly pointed out that the fact that ammonium sulphate ordinarily evolved ammonia prevented the application of a proposed method of determining the strength of standard sulphuric acid by formation of the ammonium salt.

Professor W. P. Bloxam asked if the author had made any note of the influence of the glass of the containing vessel on the dissociation of ammonium salts, and if glass had been used in the experiments.

Mr. Watson Smith, in his reply, said that he had found that soft glass had an effect on the dissociation of the salts and he had not used glass but platinum vessels in his investigations.

Dr. V. H. Veley asked to be allowed to add that, in regard to his own work, he had used hard Jena glass flasks, and had tried a blank experiment in each case previously. Experience had taught him that it was worse than useless to steam out a glass flask, as had often been suggested, with a view to minimizing the action of the glass. He had found that the best way was to allow the glass of the flask to soak for some hours in a solution of the same strength as that with which the flask was afterwards to be used.

ESTIMATING HYDROGEN IN GASEOUS MIXTURES.

In the "Chemical Trade Journal" early last year, attention was called to a paper by Herren Paul and Hartmann, in which they described a method whereby hydrogen could be quantitatively absorbed from gas mixtures as simply as carbon dioxide is removed by potash. Their solution, which was contained in a simple Hempel pipette, was a 2 per cent. solution of sodium picrate containing also 2 per cent. of a colloidal preparation of palladium. This served only as catalyst, and the hydrogen was used up in reducing the picric acid to triaminophenol. When the greater part of the picric acid has been reduced, the action becomes so slow that it is convenient to renew the solution, and in time this is absolutely necessary. In a further article on this subject, our contemporary points out that the palladium is very costly, and therefore it is important to know not only how to recover it, but to obtain it in colloidal solution suitable for use in the hydrogen pipette. This was explained in a recent number of the "Chemiker Zeitung" by Herr O. Brunk, to whom the method was communicated by Herr Paal.

When the solution begins to be slow in its action, it is removed from the pipette and cautiously acidified with sulphuric acid until no further precipitation takes place. It is necessary to use caution, as in presence of air an excess of acid palladium may pass into solution as sulphate and be lost. The precipitate contains the colloidal palladium, together with the protective colloid used by the makers (sodium protalbinate) and some unreduced picric acid. The precipitate is washed, and no attention need be paid to the yellow colour of the washings, which does not denote loss of palladium, but is due to picric acid, and which, on account of the slight solubility of picric acid, persists even after very thorough washing. The precipitate is next suspended in water and sodium hydroxide cautiously added until the disappearance of the precipitate. A fresh supply of sodium picrate is added, and the mixture is ready to return to the pipette.

Herr Brunk uses as much as 5 grammes of sodium picrate per 100 c.c.; and such a solution has, of course, a longer useful life than the original solution of Paal and Hartmann. Brunk has been using the method ever since it was described, and finds it accurate and convenient. The time of absorption may be somewhat reduced, and the necessity for shaking avoided, by substituting for a simple pipette one like those used for phosphorus, and filling this with solid glass balls (not beads, which entangle gas bubbles). The gas is passed into the pipette, and after five minutes is returned to the measuring-tube, again passed to the pipette, left there five minutes, and then again measured. So long as any reduction in volume is noticed, the process is continued.

MIDLAND ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

Annual Meeting in Birmingham.

The Annual General Meeting of the Association was held last Thursday, at the Grand Hotel, Birmingham. At the opening of the proceedings, the retiring President, Mr. VINCENT HUGHES, of Smethwick, occupied the chair.

The HON. SECRETARY (Mr. Harold E. Copp) read the minutes of the last autumn meeting, and they were confirmed.

ELECTION OF NEW MEMBERS.

The HON. SECRETARY read the names of the candidates for election to membership. They were as follows: Dr. W. B. Davidson, of Birmingham; Mr. Cecil C. Barber, of Birmingham; Mr. R. S. Hilton, of Birmingham; Mr. William M'Intosh Valon, of Stafford; and Mr. Harry Large, of Newport, Salop.

The PRESIDENT moved the election of the gentlemen named.

Mr. S. O. STEPHENSON (Tipton) seconded the motion, which was unanimously carried.

DISTRICT ASSOCIATION REPORTS.

On the proposition of the PRESIDENT, seconded by Mr. A. COOKE (Oldbury) it was resolved to forward to all members not in arrear with their subscriptions, a copy of the volume of "District Association Reports" for 1910.

AN ACKNOWLEDGMENT.

The HON. SECRETARY reported that, in accordance with the resolution passed at the last meeting, he had written a letter of condolence to Mrs. Smedley, widow of the late Mr. G. B. Smedley, of Swadlincote. Mrs. Smedley had made acknowledgment of the communication; and, in the course of her letter, she had asked him (the Hon. Secretary) to state that she had opened a boarding establishment at Bournemouth, and would be glad to have the patronage of members of the Association.

THE BENEVOLENT FUND.

The PRESIDENT said, as Mr. Cooke had undertaken certain duties in connection with the Benevolent Fund of the Institution of Gas Engineers, perhaps he would call attention to what had been done in the matter.

Mr. A. COOKE (Oldbury), said that, pursuant to the instructions of the Committee, he had written to 44 members of the Association who did not subscribe to the Benevolent Fund, pointing out the advantage it would be to the Association if they would do so. In the letter, he said:

> At the last meeting of your Committee, the claims of the Benevolent Fund were fully considered and discussed; and it was unanimously resolved to make an appeal to non-subscribing members of our Association, in order to induce them to contribute to so worthy an object.
>
> The Benevolent Fund Committee have always given special attention to the claims of the Midland Association; and during the last few years have made an annual grant of £46 16s. to the widow and young family of one of our deceased members. Our annual subscriptions at the present moment amount to £44 15s.; and the Committee feel that the members of the Association will do all they can to increase this amount, in order to place beyond doubt the continuance of this handsome allowance. I therefore appeal to you to become a subscriber to the fund.
>
> I shall be very pleased to receive your subscription, and will forward it to the Secretary of the fund in London, who, I need not say, will gladly acknowledge the receipt of same.

From the 44 members to whom he wrote, he only received one reply, enclosing half-a-guinea. He did not know the reason for this reticence; but he did feel that they should become subscribers, in order that the Benevolent Fund Committee might properly deal with the claims as they were made.

Mr. T. BERRIDGE (Leamington) remarked that, in addition to the case referred to by Mr. Cooke, there was the instance of Mrs. Smedley, who had received substantial help.

The PRESIDENT asked how many members of the Association were now subscribers?

Mr. COOKE replied that the Association had a membership of 114, and there were 44 non-subscribers to the fund.

The PRESIDENT remarked that, this being so, they had seventy subscribers. One thing that, in his opinion, militated against the members of the Association who were in charge of small works was that they thought a large subscription was necessary—say, not less than half-a-guinea. This was quite a mistake. The Benevolent Fund Committee would be very pleased to receive contributions of 5s., or whatever the managers of small works would like to send. It would be very gratifying if every member of the Association would subscribe something, if only a small amount. There was another matter mentioned by Mr. Cooke, which appeared to him (the President) to be of considerable importance. It would be noticed that one of the recipients of assistance from the fund received nearly £1 a week. He believed there were other cases the Benevolent Fund Committee had been unable to assist to any extent, because of the exhaustion of their funds. Perhaps it would be well if the Committee could reduce an amount of this kind, and let someone else equally deserving receive some small sum.

Mr. BERRIDGE remarked that he thought the President was entirely wrong. He (Mr. Berridge) was a member of the Committee, and he did not think a single application had been received yet which had been refused, nor did he know that the funds were exhausted. As a matter of fact, they were not. What was wanted was more money to enable the Committee to do more effective work; and he thought every member of the Association could afford to do something.

Mr. CHARLES MEIKLEJOHN (Rugby) remarked that there were many cases which could be helped if the funds were supplemented; but these cases were not, under present circumstances, put before the Committee. The members of the Association ought to remember that in the old days, when they had cases of their own in connection with the Midland Association, they used to appeal individually to the members, and in this way large sums were raised for individual cases. It was, however, then thought better that they should all join in subscribing to the Benevolent Fund, so that the central fund should bear the entire cost, instead of making individual appeals to the members of the Association. He would be very glad if the 44 non-subscribers of the Association would become contributors, if only to a small amount.

Mr. COOKE said he should not like it to go forth that the case referred to in his letter should have the relief reduced. It was an exceptionally deserving case.

The PRESIDENT said he remembered that they had a communication from the Benevolent Fund Committee a few months ago in which it was stated they could not give any further help.

The HON. SECRETARY thought what was said was that they could not, without further funds, entertain any additional applications whatever.

Mr. BERRIDGE observed that there was not, he was sure, any case that had been refused. As the representative of the Association on the Benevolent Fund Committee, he should like to know of any case if there was one. Besides the cases that had been mentioned as having received relief in connection with deceased members of the Association, there were two or three others that had been receiving relief for many years now.

The PRESIDENT said he did not by any means suggest that the two cases mentioned covered the whole of the relief that had been received from the Benevolent Fund within the Association area.

ANNUAL REPORT AND ACCOUNTS.

The HON. SECRETARY, in presenting the annual report of the Committee and the accounts, remarked that the balance in hand at the beginning of the year was £82 13s. 8d., and at the end it was £74 4s. 7d. The reason for the diminution was that last year there was a greater number of subscriptions paid in advance than there had been this year. The report reviewed the proceedings of the past year, and wound up with the statement that during the twelve months two new members had been elected, there had been two deaths, and one member had resigned. The total number of members on the books at present was 110.

On the motion of the PRESIDENT, seconded by Mr. A. BIRD (Bromsgrove), the report and accounts were received and adopted.

JOINT MEETING OF THE JUNIORS.

The HON. SECRETARY reported that he had received a letter from the Secretary of the Midland Junior Association, which he had brought before the meeting of the Committee of the Senior Association. The letter informed them that there was to be a joint conference of the Junior Association to be held in Birmingham during May. He (Mr. Copp) believed the Junior Association were extremely anxious that this Association should render all assistance possible in making the meeting a success. He believed the Junior Associations had previously had two joint conferences—one of them he knew was at Manchester, and it was a great success. The Midland Junior Association was exceedingly anxious the meeting in Birmingham should be equally successful.

Mr. R. S. RAMSDEN (Burton-on-Trent), the President of the Midland Junior Gas Association, invited by the President, said there had been one or two Special Committee meetings of the Junior Association to discuss the proposed visit. But so far, they were working in the dark, and had no fixed programme. If the Senior Association could appoint one or two representatives to co-operate with them, it was thought that their experience would assist them in arriving at some decision, and would make the proposed visit a greater success. Mr. Copp had mentioned that a date had been fixed in May. No date had yet been definitely fixed; but the one that had received most favour up to the present was Saturday, May 13. As to the arrangements, so far as they had been talked over at present, the idea was to have various programmes going on simultaneously. It was anticipated that the gathering would be too big for them all to visit one works at the same time. They wanted to have visits to the different works of the Birmingham Corporation, and make a feature of the new high-pressure plant. At the same time, if there was an exhibition at (say) Bingley Hall, they would make another feature of that.

Mr. T. BERRIDGE (Leamington) moved that the new President, the Hon. Secretary, and Mr. Meiklejohn, together with the General Manager of the Birmingham Corporation Gas Department (who had been elected a member of the Association that day), should form a Sub-Committee to assist the Juniors in formulating their

plans, and that they be granted a sum not exceeding ten guineas to support the project.

Mr. MEIKLEJOHN said, though his heart was in full sympathy with the Junior Associations, he was bound to say that it would be absolutely impossible for him to undertake any work in connection with the Committee.

The PRESIDENT hoped Mr. Meiklejohn could attend the Committee occasionally, and assist in the making of the arrangements. The Juniors would highly appreciate it.

Mr. MEIKLEJOHN said it was not in his case by any means a question of sympathy; but he did not like to undertake work that he felt it would be impossible for him to fulfil.

Mr. J. A. HARRIS (Wigston) seconded the motion, which was heartily carried.

Mr. RAMSDEN said he should like to express the thanks of the Junior Association not only for the personal assistance the Senior Association were giving to them in formulating their plans, but for their financial support. He was sure it would be found that it was co-operation well applied.

RETIRED GAS MANAGERS.

The PRESIDENT said there was another matter the Committee had thought of bringing before the members that day, but it was not quite ripe. Owing to the alteration of the rules, there were a number of members of the Association who were no longer eligible for membership. This was a very delicate matter and a very difficult one with which to deal. It was almost a painful one, because they did not like parting with old friends. But the Committee felt the rules as now amended should be strictly adhered to. He did not think there was a single dissentient in the Committee over this matter. There were some retired gas managers whom they would like to retain as members, but who were now engaged in business, and probably they ought not to entertain their membership any longer. Perhaps the members would consider the matter between now and the next meeting.

Mr. S. O. STEPHENSON (Tipton): Is that apart from those who have been elected honorary members?

The PRESIDENT: Yes.

THE NEW PRESIDENT.

The PRESIDENT said the time had come when he must give up command of the ship to the new skipper; and he had no doubt they would have a very fair voyage. They knew that Mr. Brown was a thorough good worker, and combined with that they knew that he possessed high scientific knowledge. They consequently looked forward for great things during the next twelve months. He had his heartiest wishes for a good year of office.

Mr. J. H. Brown (Nottingham) took the presidential chair, and at once proceeded to deliver the following

INAUGURAL ADDRESS.

I thank you for the honour you have conferred upon me in electing me President of our Association. I can assure you of my very deep sense of the honour you have done me, and of my appreciation of the responsibility attached to the position. No effort shall be wanting on my part to maintain the honour and dignity of our Association; and I confidently appeal to you for the generous support which has always been so kindly extended to previous occupants of the Presidential Chair.

We have to deplore the loss of two members during the past year—Mr. Alfred Colson and Mr. George B. Smedley. I have, however, the pleasure to report a substantial increase in our membership; and we are all especially glad to welcome the new members from the staff of the City of Birmingham Gas Department. Our Association was never stronger than it is to-day. The gas industry, at the present moment more than ever, needs active and efficient Gas Associations and courageous and well-equipped gas engineers, capable of fully appreciating the trend of modern developments, and of seizing the many opportunities of advancement made possible by the recent modifications in legislative enactments, and by the numerous developments and improvements in apparatus and plant for the manufacture and use of gas. Unless our Association stimulates and assists its members in their work, it will not fulfil the object for which it was established or justify its existence. I appeal, therefore, to the members to do all they possibly can in attending the meetings of our Association, and in the reading and discussion of papers, to help to maintain the high tone and character of the proceedings for which the Midland Association has so long been famous.

In all technical industries, actual experience is always of greater value than theoretical treatises; and, acting on this assumption, I propose to lay before you to-day a very brief and incomplete outline of some of the work done at Nottingham during the last eight years.

NOTTINGHAM AND ITS GAS DISTRIBUTION.

On receiving the appointment of Gas Engineer to the Nottingham Corporation in 1902, I realized that among the many matters calling for earnest attention, the one that would need the greatest care would be the distribution of gas throughout the hilly parts of the city and the large and extensive colliery districts included in the parliamentary area of supply. I found that the whole of the city, including the high-lying and the low-lying districts, was supplied in one area by seven or eight governors from the three gas-works, and that some of the out-townships supplied by the Corporation were also connected to the same network of mains that served this same city area. Satisfactory control of the pressures in the high-lying districts was impossible, and the pressure at the consumers' services fluctuated between very wide limits. I at once decided upon districting the city area—separating it from the trunk or feeder mains supplying the outlying townships.

The natural difficulties of the work of reorganizing the gas supply to an area covering some 250 odd square miles, were greatly increased by the fact that only very misleading plans of the mains could be found, which, after causing confusion and almost disaster, were finally abandoned—the positions of all the important mains having to be verified by actual excavation and inspection.

After three years' work, the city proper was divided into ten districts, having regard both to altitude and the best means of supplying each district by existing mains. Each gas-works has now its own clearly defined district of supply; and each governor supplies one complete and distinct district. One of the larger city areas can be supplied from all three gas-works; some such arrangement being necessary to adjust the output to the daily make of gas, although the smallest of the three works can pump gas into its holders from the two larger works through a 30-inch ring main.

One small but important part of the city area is fed from two trunk mains supplying out-townships some five or six miles away from the city. The supply to this area is taken through two local mercurial governors erected in subways under the pavement. This plant was installed four years ago, and is still working exceedingly satisfactorily. The quantity of gas in this case is comparatively small in proportion to the quantity passing through the trunk mains; and the supply to the outlying districts is not in any way affected.

A gasholder has been erected at the chemical works, some eight miles from the centre of the city. This holder is filled during the day; and at night it supplies gas through a 10-inch main to a colliery district about two miles away. The pressure to this district is controlled by an electrically operated water-loading governor, which has worked during the last ten to twelve years with unfailing regularity, and maintained an absolutely constant pressure in the mains of the district.

After having districted the whole of the parliamentary area of supply, some portions of which lie at a distance of 10 to 14 miles from the centre of the city, it was found necessary to deal with the supply from the gasholders to the governors at the largest works. At these works, there were eight governors—two 30-inch, two 24-inch, one 18-inch, two 14-inch, and one 6-inch—all supplied through one 30-inch main connecting the outlets of the four gasholders. Consequently, during the period of maximum demand, the fall in pressure between the gasholders and the governors was greater than the fall in pressure between the governors and the most distant consumer. To meet this difficulty, an entirely new works distribution system was installed. [The President explained the diagrams reproduced next page.]

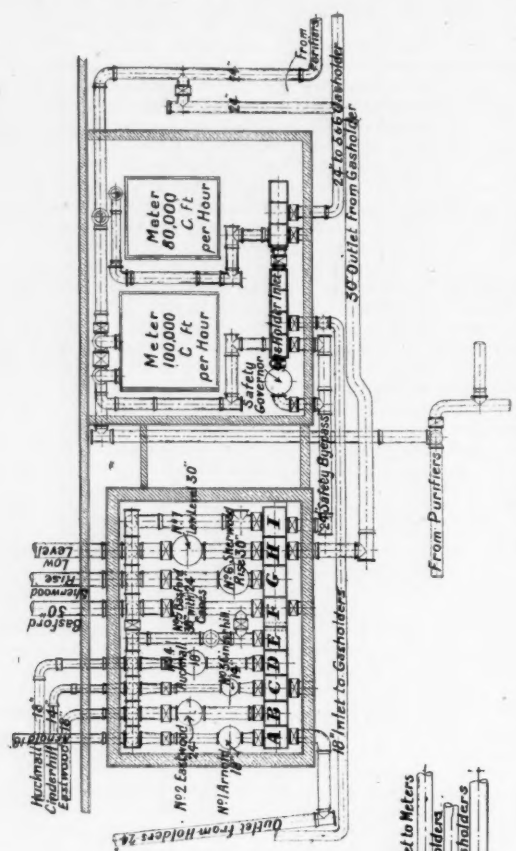
When reconstructing the distribution house, no combustible material of any description was used. The governors and valves are completely exposed and entirely accessible. The style of bye-pass and bye-pass valve are of special interest; also the water-valve separating the governors supplying the city areas from those supplying the outlying townships. A safety governor is also fitted, which automatically connects the inlet to the meters to the outlet boxes, in the event of the holder outlets being accidentally shut off. A central water-loading governor was also provided.

In conjunction with this constructional work and alterations to the feeder mains, the whole network of mains and services was subjected to a close and systematic examination. Wherever any trace of leakage was apparent, the ground was barred and lead joints carefully set up. In a few instances, where rubber joints had been used in laying large gas-mains, the rubber was driven back, and the joints were run with lead. The services are now laid in wood troughing, and completely covered with cement concrete; all service holes being drilled in the mains with a saddle drilling machine.

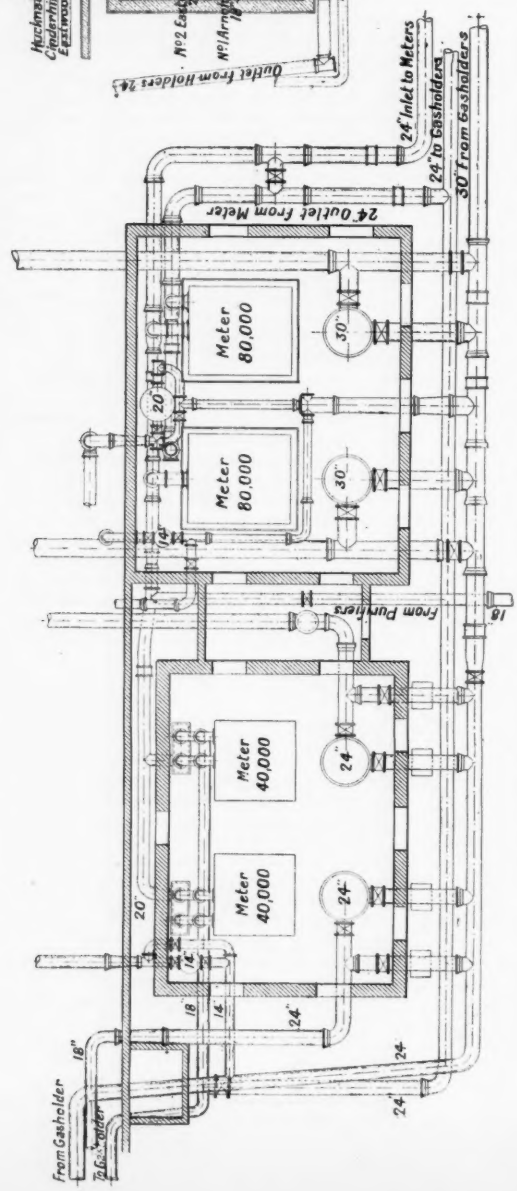
The meters also received special attention; and a rigorous system of inspection and testing was put in operation. Wet meters only are let out on simple hire. It is found that the three-light slot meter is very rapidly displacing the three-light wet meter previously in use on rent.

Not only is the closest attention given to the quality of materials used, but, what is perhaps of even more consequence, the method of supervision of the workmen employed in the distribution department has been thoroughly reorganized. All main and service layers, and meter and stove fixers, are provided with a numbered uniform, and prepare each day a time-sheet showing the times of their departure and arrivals at the works or consumers' premises throughout the day. Each of the four branches is under its own foreman; and the time-sheets are checked day by day. The system in vogue is welcomed by the conscientious workmen; and the general improvement in the quality and character of the work has enabled the Gas Committee to grant very substantial increases in the rate of pay to these classes of workmen.

The gasholders, which are included for this purpose in the distribution department, always repay any special attention they may receive. For some years they have been painted with a specially prepared neutral coal-tar varnish, which costs, perhaps, one-tenth the price of oxide paints, but which has the advantage of sealing all pin-hole and joint leakages, so common with the majority of gasholders after a few years' service. I attribute a



Plan of New Meters and Governors.

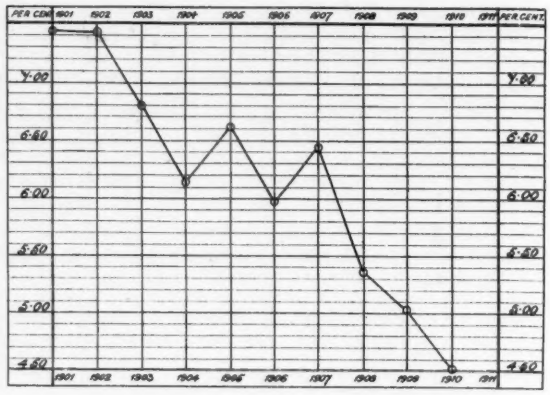


Plan of Old Meter and Governor House—Basford Gas-Works.

sensible proportion of the diminution in the unaccounted-for gas to the use of this varnish in lieu of more expensive oxide paints.

LEAKAGE.

The effect of the care bestowed in distribution is clearly indicated by the following diagram, which shows a gradual reduction in the leakage from 7·42 per cent. in 1902 to 4·5 per cent. in 1910.



Unaccounted-for Gas—Leakage Per Cent.

Reduction: 7·43 per cent. to 4·50 per cent.; or a saving in 1910 compared with 1902 of 61,000,000 cubic feet of gas per annum.

Time will not permit me to give you details of the apparatus installed for the boiling, cleaning, and polishing of gas-cookers and for the verification, in batches, of dry and wet meters.

A large showroom is being maintained for the exhibition of the latest class of stoves, fires, and apparatus by the best makers.

Specially favourable terms have been offered to the plumbers and ironmongers in the city, with a view to securing, as far as possible, the co-operation of these tradesmen with the Gas Department in the use and sale of gas.

Unfortunately, we have not yet been able to undertake the work of mantle maintenance and burner inspection—a work which I consider of the very utmost importance if we are to maintain our lighting load in face of the present active competition of metallic filament lamps—nor have we yet been able to inaugurate, as we hope to do at some future date, the regulation and control of the size and condition of the gas-fittings in all new buildings erected within our gas area.

THE CARBONIZING PLANT.

At the three gas-works, there were two benches of inclined retorts containing sixteen beds of sevens; three benches of horizontal retorts (thirty beds of eights) in one house, operated by West's compressed air stoking machinery; three hand-worked retort-houses containing forty-four beds of sevens, direct-fired horizontal retorts; and one retort-house with sixteen beds of horizontal sevens, regenerators. There was also an oil-gas plant which was worked temporarily, and was finally converted to a blue water-gas plant with satisfactory results.

An attempt has been made to sectionize each of the works so that each retort-house can be kept under separate control. But, so far, it has only been possible to carry this out to a certain limited extent. Great advantage, however, has already accrued through the work that has been done; and it is hoped that the sectionizing will be completed at some future date.

The sectionizing of the work clearly indicated the least efficient portion of the plant. The inclined retorts were a considerable source of trouble, and a constant anxiety; and although I now consider them as reformed characters, like all such, they need special thought and attention.

After many experiments and trials, it was decided to clear out the arches, and to replace the two inside horizontal combustion chambers in each bed by one combustion chamber formed parallel with the axes of the retorts, in order to secure regular heating, and thus avoid the creeping of the charge in the retorts. The regenerators were also renewed at the same time.

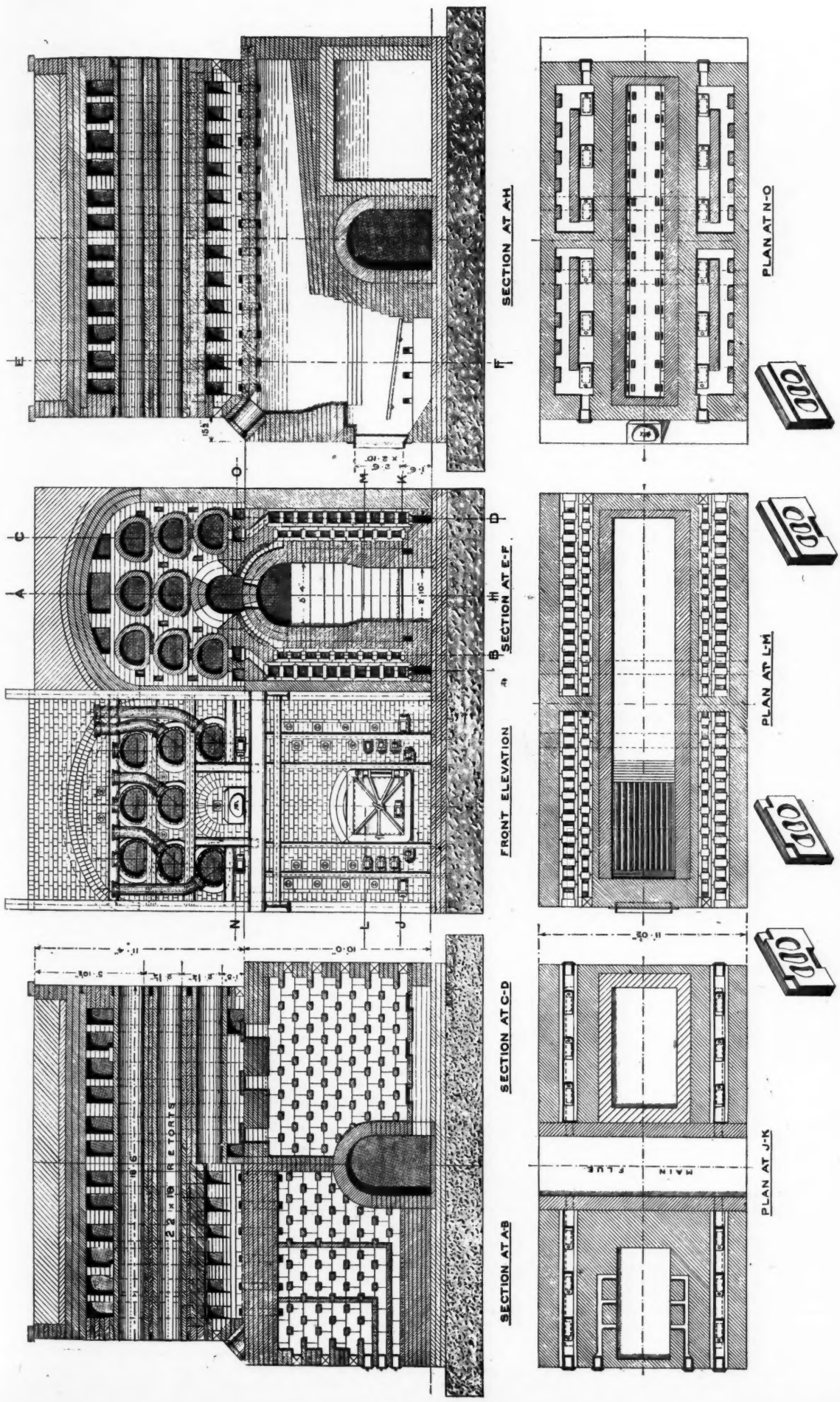
This retort-house is regularly working every winter; and fairly satisfactory results are being obtained. The life of the retorts, however, is short; and the repair and maintenance costs are exceedingly high. Regular and fairly high heats are now obtainable; and a much larger yield per retort-life has been made possible.

Several types of retorts, both brick and built, have been tried in lieu of moulded, but with unsatisfactory results.

With increased heats, stopped pipes and pitched mains became a constant source of trouble, until the hydraulic, tar, and foul mains were remodelled, and tar columns and retort-house governors installed. The same design of hydraulic main has now been installed throughout the three gas-works.

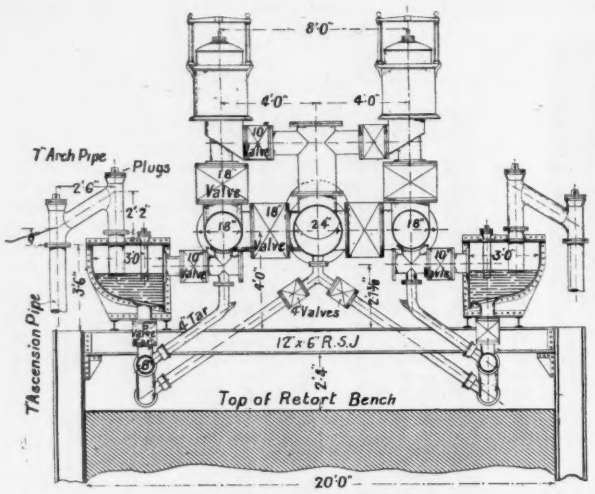
The hand-worked bench of regenerative settings (sixteen beds of eights, 15-inch by 21-inch ⊓, 18 feet long) has been equipped with De Brouwer charger and discharger machinery, and with coal and coke handling plant.

Owing to the large proportion of cannel coal used (about 35 to 40 per cent.), great trouble was at first experienced in charging the



REGENERATIVE RETORT SETTING—NOTTINGHAM CORPORATION GAS-WORKS.

J. H. Brown's Patent—See "Journal," Vol. XCIV., pp. 449-50.



Cross Section Showing Hydraulic Mains, Gas, and Tar Connections, 10-Inch Retort Governors—Basford Gas-Works.

retorts with cannel, and in pushing out the coke produced by the Derbyshire coal and cannel. After passing through a period of difficulty—due largely to the condition of the retorts—fairly satisfactory and improving carbonizing results are now obtained.

The largest portion of the producing plant, however, is operated by West's compressed air machinery. The large retort-house now contains forty beds of eights (21-inch by 16-inch D, 20 feet long). The thirty old regenerator settings have been rebuilt and new regenerators erected.

The stoking plant has not been modified in any way; but it is maintained in as perfect a condition as possible, and excellent carbonizing results are being obtained.

Throughout the three works the same design of regenerator settings has been adopted; and coals from the same collieries are being used. The size and shape of the retorts are shown on the accompanying plan. I am therefore in a position to ascertain to a certain extent (to my own satisfaction, at any rate) the relative advantages of: (A) Inclined retorts; (B) direct-fired horizontal retorts with hand labour; (C) horizontal regenerators with De Brouwer machinery; (D) horizontal regenerators with West's compressed air machinery. The results obtained from each type of plant are given for a period of three months:—

Comparative Workings over a Period of Three Months.

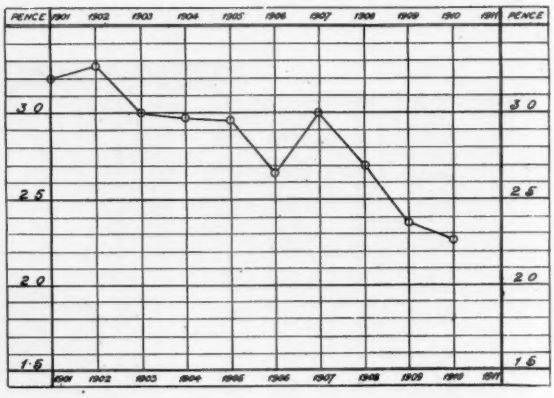
—	A	B	C	D
	Inclines. Regenerators.	Direct Fired Horizontals. Hand Labour.	Horizontal Regenerators. De Brouwer.	Horizontal Regenerators. West's Machinery.
Gas made per ton	11,000	11,041	11,300	11,550
,, per mouthpiece	7,500	5,950	7,000	8,200
,, per foot of retort	682	633	757	820
Candle power (No. 2 burner)	18·10	18·24	18·10	18·30
Sperm, pounds per ton	682	690	701	725
Calorific power—gross B.Th.U.	622	642	622	612
,, ,, net ,,	560	578	560	551
Gross B.Th.U. per ton in thousands	6,842	7,088	7,029	7,069
Net B.Th.U. per ton in thousands	6,160	6,382	6,328	6,364
Carbonizing cost, per ton	33·72d.	47·80d.	21·80d.	20·80d.
,, ,, per 1000 c.f.	2·16d.	4·37d.	1·94d.	1·92d.
Percentage of cannel used	22	36·6	20	24·4
Life of retorts, days	700	950	1,000	1,000
Length of retorts	22 ft. 0 in.	18 ft. 6 in.	18 ft. 6 in.	20 ft. 0 in.

In all cases purification is by oxide alone. But at the largest works the gas is freed from cyanogen; otherwise the conditions are identical. The illuminating powers are taken by an independent official. My experience goes to show that high candle powers cannot be obtained so easily in inclined retorts, or horizontal retorts worked with the projector type of charger, as with the scoop type of machine. The packing of the coal tightly together gives a high make per ton, large yield of ammonia, and comparative freedom from naphthalene: but high sperm value (fortunately a term as defunct in most works as the dodo) can much more easily be obtained with lightly and loosely packed charges.

The relative proportion of coal and cannel used at the Nottingham works is as follows: Yorkshire, 30 per cent.; Derbyshire unscreened, 40 per cent.; cannel, 30 per cent.

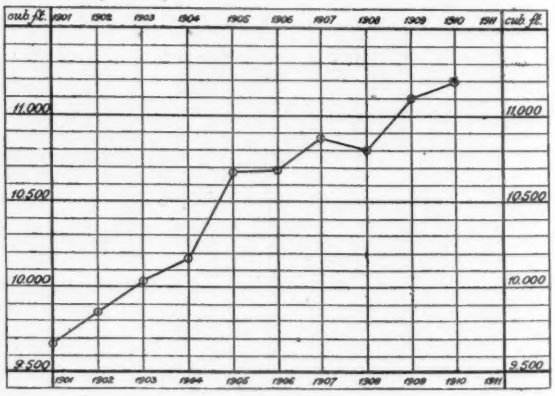
In the setting shown on the drawing, an attempt was made to utilize the waste heat to generate steam from the water in the ash-pan; but it was found that the available heat was not sufficient to warrant the required alterations being made.

In 1906, it was proposed to instal outside producers to generate Mond gas from the refuse coke breeze for heating the thirty through settings in the long horizontal retort-house. A sample of the breeze available was sent to the Mond Gas Company; and they were prepared to guarantee the production of about 70 lbs. of ammonia per ton of fuel used. Owing, however, to the extensive character of the alterations necessary, and the difficulties that were feared in obtaining satisfactory heating in the settings with Mond gas, the proposal was not proceeded with.



Carbonizing Cost per 1000 Cubic Feet of Gas Sold.
The saving in 1910 compared with 1902 is equivalent to £5400. During this period the rate of wages has twice been advanced by 10 per cent.

The alterations made to the carbonizing plant, and the installation of large, roomy hydraulic mains and tar-columns, have had a marked effect on the carbonizing results obtained. The following diagram shows the increase in the make per ton from 9800 cubic feet in 1902 to 11,200 cubic feet in 1910.



Gas Made per Ton of Coal.

1902 Gas sold per ton, 9146 cubic feet.
1910 Total gas sold, 1,980,617'900 cubic feet.

$$\frac{1{,}980{,}617{,}900}{9{,}146} = 216{,}550 \text{ tons of coal required during 1910}$$

Tons of coal actually used in 1910 = 185,247 tons

Saving effected = 31,303 tons
Or equivalent to a saving of 60 tons of coal per week.

In 1906, an installation of Dellwik water-gas plant was erected. The results obtained from this, in conjunction with the Lewes process, have been published in detail, and no further comment is needed, except the affirmation of my belief in the greater possibilities of the system. In the Dellwik system, which gives 60,000 cubic feet of gas per ton of coke, of a calorific value of at least half that of coal gas, there still remains a source of heat and power which has not been fully developed. This type of plant is bound to receive greater attention as gas becomes more largely used for the heat units it contains.

At a subsequent date, a carburetted water-gas plant was erected, and has since been extended to produce 2,500,000 cubic feet of gas per diem in two units. The plant is now equipped with steam and air meters and pyrometers—in fact, the control of the plant is entirely independent of the skill of the operator. I had some misgivings as to the continued reliability of the two pyrometers in use on this plant for controlling the temperature of the carburettor and superheater; but extended experience has convinced me that the use of these instruments almost entirely eliminates the personal element so far as the operators are concerned, and working results are thereby obtained which would otherwise be impossible.

Although exceedingly satisfactory carbonizing results are being obtained from this plant, it cannot well compete with the ordinary coal-gas plant for the production of gas in bulk. Its erection has, however, rendered unnecessary the building of a new gasholder; and as an auxiliary modern plant, and in other respects, it is of inestimable value.

Carburetted Water-Gas Plant at the Basford Works.

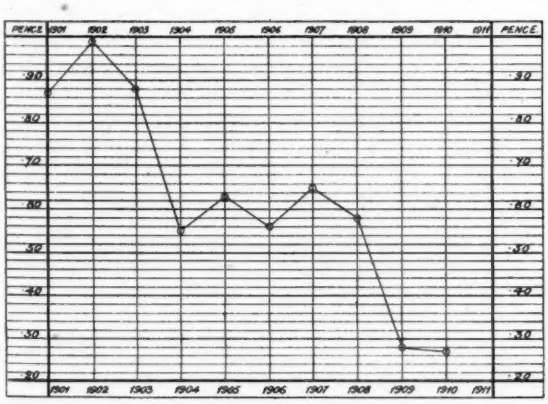
GAS MADE (CORRECTED) at normal temperature and pressure.
CANDLES PER GALLON PER 1000 CUBIC FEET.—
(A) With the No. 1 "London" argand burner, 5 cubic feet rate.
(B) ,, No. 2 "Metropolitan" ,, ,, ,, ,,
COKE USED AT GENERATOR.—Gross coke fed into generator, including coke used for getting up heat.
CYCLE.—Two minutes' blow, five minutes' run.
AIR USED for generator and secondary air supplies to carburettor and superheater.
STEAM.—Pounds per minute, passing through generator while gas making.
CALORIFIC EFFECT.—Gross B.Th.U.—300 B.Th.U. for B.W.G. divided by the oil used per 1000 cubic feet.
GENERATOR BLAST, CLOSED TRENCH.—Pressure in inches of water of blast in trench when air-valve to generator is closed.
STEAM PRESSURE ON FLOOR.—Boiler gauge read on operating floor.
COKE.—No allowance has been made for moisture or ash in coke, which might average 7 per cent. ash and 5 per cent. moisture.
PURIFICATION.—Gas is purified with oxide; no lime being used.
GAS is sampled by drawing a stream into a small holder while plant is working; CO_2 results are obtained from the Orsat apparatus.

Average Workings of Carburetted Water-Gas Plant, Sept. 16-22, 1910.

Gas made at N.T.P.	3,300,000 cub. ft.
,, ,, per hour	42,200 ,,
,, ,, per run	5,560 ,,
Oil used	9,362 galls.
,, ,, per 1000 cubic feet	2·83 ,,
Illum. power per gallon per 1000 cubic feet—	
With the No. 1 "London" burner	6·36 candles
,, ,, No. 2 "Metropolitan" burner	7·15 ,,
Coke used at generator	100,700 lbs.
,, ,, ,, ,, per 1000 cubic feet	30·5 ,,
Water used	46,800 galls.
,, ,, per 1000 cubic feet	14·2 ,,
Number of hours working	77·15
,, ,, runs	594
Cycle	2 and 5
Number of clinkerings and times taken (minutes)	8–336
Air per 1000 cubic feet of gas made	1,710 cub. ft.
Steam used per 1000 cubic feet of gas made	27·3 lbs.
Temperature of superheater base	1,305° Fahr.
,, ,, top	1,290° ,,
Illum. power with No. 1 "London" burner	18·0 candles
,, ,, ,, No. 2 "Metropolitan" burner	20·2 ,,
Calorific power, gross and net	586–548 B.Th.U.
,, effect	101 ,,
CO_2	4·3 per cent.
Specific gravity of gas	·657
Depth of fuel	6 feet
Pressure of blast in closed trench	$16\frac{3}{4}$
Steam pressure on operating floor	123

PURIFICATION.

In the purifiers, oxide only is used. Owing, however, to the high percentage of carbonic acid in the gas, some difficulty was experienced in maintaining the high candle power standard; but by careful attention to the washers and carbonization, the carbonic acid has now been reduced to such proportions that purification by oxide alone presents no difficulties. The sulphuretted hydrogen and sulphur compounds are also reduced to a fairly average figure. No air whatever is used to assist purification. An analysis of the composition of the gas, and a test of its calorific value, are taken daily; and the following is an approximate average:



Net Cost of Purification per 1000 Cubic Feet of Gas Sold.
Saving effected in 1910 compared with 1902, £5942 per annum.

	Per Cent.
CO_2	2·4
Hydrocarbons	4·6
O_2	0·4
CO	6·8
CH_4	34·2
H_2	45·7
N_2 (by difference)	5·9
	100·0

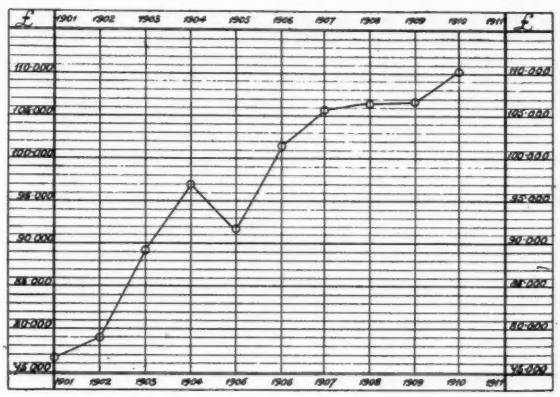
Calorific power, gross	620 B.Th.U.
,, ,, net	560 ,,

WORKS AND PLANT MAINTENANCE.

In the repair and maintenance of the works and plant, many minor alterations have been made in bringing the auxiliary up to date. Experiments have been conducted with the various forms of silica and fire-clay available, and the most suitable forms of setting. We are now satisfied that, relative to price, we are obtaining the most suitable material for our work.

In the general maintenance of the plant, it has been found desirable to abandon entirely the use of oxide paints for those portions which are formed of steel or cast iron; and the substitution of a neutral tar varnish has been found more satisfactory and economical.

Improved technical results are of little advantage unless they produce corresponding improvement in financial returns. Very often a high make per ton, or low carbonizing costs, are purchased at too high a price, or, by reason of excessive capital expenditure or other similar means, are secured to the detriment of the general financial standing of the undertaking. The following diagram will show at a glance the steady progress maintained in the gross profits of the Nottingham gas undertaking; an improvement which has taken place notwithstanding continued reductions in the price of gas to consumers during the period under review.



Gross Profit.

In 1902 the gross profit was	£75,907
,, 1910 ,, ,, ,,	110,297
Increase	£34,390

Add reduction in the price of gas—viz., 2s. 8·93d. to 2s. 6·18d. which is equivalent to an annual sum of £22,695.
£34,390 + £22,695 = £57,085, or a saving of £1100 per week.

THE TREND OF THE GAS INDUSTRY.

Turning, now, to the general trend of the gas industry, at the present time the gas industry, as a whole, is experiencing a period of exceptional prosperity. In the last official returns, the gas consumption for Great Britain is given as 178,000,000,000 cubic feet; showing a considerable advance on previous records. Markets for our requirements are in a comparatively favourable condition. Coal, particularly, can be bought at advantageous prices; and but for recent abnormal legislation limiting the working hours of adult labour, the increased production of coal would have placed this commodity in an even more favourable position, so far as gas undertakings are concerned.

The markets for residuals during the past few months have been exceptionally favourable, though the recent spurt in coke prices came, unfortunately, after the time contracts are usually made for the disposal of the winter's output. Tar products, after a temporary set-back, have again shown an upward tendency. Carbolic acid has doubled in price, due to the Mongolian bubonic plague. Sulphate of ammonia is showing exceptional strength, and prices are the highest known for several years.

The removal of unnecessarily restrictive clauses as to the purity and illuminating power of the gas supplied to the majority of large towns has greatly assisted in reducing the cost of manufacture, and in popularizing the use of gas for domestic purposes. No more striking example of the value and advantage of recent gas legislation can be found than the progress which has been made by the two largest Metropolitan Gas Companies. The freedom thus made possible has given scope for able administrators to adjust their operations to the needs of the moment; and more progress has been made during the last two years than in any previous decade.

Our industry needs more than ever highly-trained technicians in the supreme control of its large undertakings. The development and training of suitable men for such responsible posts is a matter that is exercising the minds of all who have a keen interest in the gas industry. The gas profession, as a career, offers advantages and opportunities quite equal to those offered by any other industry; and it is to be hoped that our District Associations and the Institution of Gas Engineers will strive their utmost to improve the prestige and the standing of the members of their Associations.

In the past, membership of these Associations has not been difficult to obtain. The time is approaching, however, when a certain degree of technical and general knowledge should be insisted upon before election to membership; and I should be glad to see the parent Institution inaugurate a series of examinations similar to those in vogue with the Institution of Civil Engineers.

The Junior Associations of Gas Engineers will compare favourably with similar institutions in any other profession; and I feel sure that all members of these Junior Associations would welcome some test or examination which would enable them to add to their many other qualifications a diploma issued by the Institution of Gas Engineers.

The demands on the technical heads of our large undertakings become more varied and onerous year by year. The technical knowledge absolutely necessary now covers a very large field in chemistry, physics, electrical, and general mechanical engineering. At the present time, the process of carbonization is in a state of uncertainty and indecision. The carbonizing systems which offer such great advantages over the ordinary processes now in use in this country are so numerous that the duty of those called upon to advise their committees or directors on the introduction of any new carbonizing plant is exceedingly difficult.

The same condition of affairs exists in practically every other branch of the profession. In the system of purification, many capable investigators are actively engaged on pioneer work, and great changes may be anticipated. The removal of the restrictive test clauses, and the use of gas of lower candle power, permit, nay almost necessitate, the employment of entirely different methods. In distribution, similar influences are at work. Gas under high pressure has proved to be so economical in application that it can now successfully compete with fuels which were many times cheaper than gas under normal or low pressure. The recent developments in surface heating with high-pressure gas will doubtless open up many new fields hitherto unexplored—in fact, the general trend of developments points to the exclusive use of high-pressure distribution at no very distant date.

Broadly speaking, the day of 36-inch cast-iron gas-mains, and 10-10ths to 20-10ths distribution pressures is past. In future, steel mains, working at so many pounds pressure per inch, with reducing governors on each service, will undoubtedly take the place of our present cumbersome, inefficient, and fluctuating pressure distribution system. In this latter respect, our industry must follow the example of our competitor, the electric light industry, which some years ago doubled the pressure of their supply, reduced the size of their services, and consequently halved their copper losses. Not only was great saving effected in cables and distribution charges, but it became possible to erect large central power generating stations—in some cases, miles from the point of consumption, and in positions more favourable for the purchase of fuel and other requirements. It is quite obvious that the gas industry will be compelled at no distant date to continue its developments on these lines. Here, again, our German confrères have already taken the lead.

SURPLUS GAS FROM COKE-OVEN PLANTS.

In 1903, a coke-oven plant on the regenerative principle was erected at Lübeck, which produced for disposal approximately 5000 cubic feet of surplus gas per ton of coal carbonized in the ovens. This gas was supplied under pressure to Travemünde—a seaport town some 15 miles away. Considerable development has taken place on these lines; and for some years the two large towns of Essen and Mülheim have purchased the surplus gas produced by coke-oven plants to mix with the gas manufactured at their local gas-works. So successful were the experiments that these two towns have since closed their gas-works, and are now entirely dependent on the gas produced by the coke-ovens. The colliery companies have agreed to supply all the gas required at 8½d. per 1000 cubic feet; and in consideration of the town's gas-works being discontinued, they have taken over all the officials and workmen employed by the Gas Department, at the existing rates of pay.

The town of Bochum has also discontinued its gas-works, and is taking its gas supply from Krupp's Hannibal and Hanover collieries; and the same course has been taken at Gelsenkirchen. Many other towns have closed their gas-works, among them being Hamborn, Eickel, Wanne, Bottrop, Borbeck, Gladbeck, Dorsten, Barmen, Oberhausen, Kettwig, Heiligenhause, and Valbert. All these towns have concluded negotiations with adjoining colliery companies, and others are negotiating similar agreements.

The Municipalities of Barmen, Velhert, and Heiligenhaus have concluded contracts with the Vasserwerk Thyssen Company of Mülheim. The Barmen contract will take effect from April 1, 1911, when the municipal works will be closed. The Municipality is to receive a minimum profit of £5000 per annum. The consumption of gas at Barmen is estimated at 600,000,000 cubic feet; and the contract is made for a period of 25 years at varying prices—the maximum being less than 1s. 4d. per 1000 cubic feet. The gas in this case is conveyed 30 miles—various small townships being supplied *en route;* and it is estimated that the cost of conveying the gas, including all charges for depreciation, repairs, &c., will not exceed 3½d. per 1000 cubic feet. In one case, a similar contract has been entered into with a municipality at prices varying, on a sliding-scale, with the price of coal.

I have inspected a number of coke-oven plants abroad used for the supply of gas for lighting purposes; and I have no doubt whatever that this system will be developed to a very considerable extent. The greatest distance I have yet heard of gas being conveyed is, approximately, 40 miles; but there is no reason why, where necessary, this distance should not be exceeded. In many of our large cities, water is now brought from sources 30, 40, or even 50 miles distant; and I see no reason whatever why coal gas—a much more valuable product, and more easy to convey—should not be carried with advantage for similar or greater distances.

In the case of Nottingham, we have within a radius of 30 miles a large number of coke-oven plants, which are daily turning into the atmosphere double the quantity of gas required by our consumers. These colliery ovens would be able to deliver this gas to our holders at probably not more than two-thirds of the cost required by us for its manufacture.

TESTINGS FOR QUALITY ABOLISHED.

The availability for distribution to consumers of gases which are produced as waste products in various commercial processes, in conjunction with the more efficient use of coal gas in incandescent burners in place of the antiquated open-flame type, will compel gas undertakings to abolish the ancient fetish of illuminating power testing; and low-grade gases of constant composition and calorific power will doubtless eventually supersede the present 14 or 16 candle power gas. There is, apparently, one, and one obstacle only, that now bars the progress of low-grade gases—that is, the need of some consumers for the use of open-flame burners in exposed positions. When, however, it is possible to obtain a cheap and simple form of incandescent burner, designed on the principle of the bunsen storm cone, with the cone made of asbestos or other refractory material, coated with a solution of rare earths, giving an illuminating power of about 4 candles per cubic foot of gas consumed, and unaffected by wind or rain, then, with such a burner available, giving a higher duty than 16-candle power gas consumed in an open flame, there would be no possible argument against the entire neglect of the illuminating qualities in the coal gas supply.

GAS STOVES AND FOG TROUBLES.

In "The Times Engineering Supplement" for Dec. 27 last, a diagram was given showing the vast improvement made during the last few years in the atmosphere of London with regard to fogs. The improvement was attributed to the greater portion of the adjoining hitherto marshy land being now covered with houses and street paving. To my mind, there can be no doubt that it is more largely attributable to the displacement of vast numbers of open coal-fires by innumerable gas-fires installed by the London Gas Companies. These two Companies, the last twenty years, have installed no less than 220,000 gas-fires, representing many thousands of tons of coal per day.

Gas-fire makers are complaining that their present fires have to be made with far too concentrated a flame for efficiency or beauty of appearance, and they maintain that, with the lower prices of gas possible under the new conditions, gas-fires will be standard fittings in almost every house let at a yearly rental.

The gas industry has been threatened with extinction for the last 25 years by the development of the electricity industry; but I venture to suggest that the development of the gas industry, stated either in terms of heat units, illuminating power, or cash value, has far exceeded that of electricity. When the gas industry is able to abandon the unnecessary and restrictive clauses imposed by a too conservative and grandmotherly legislation, the progress which will be made in the next 15 years will far exceed anything which has taken place since the days of Murdoch.

Mr. A. Cooke (Oldbury) proposed, and Mr. S. O. Stephenson (Tipton) seconded, a resolution conveying a hearty vote of thanks to the President for his address.

The President acknowledged the vote.

The Fitting Department.

Mr. W. W. Townsend (Hereford) read a paper on "The Fitting Department." This, with a report of the discussion which followed, is published elsewhere in this issue.

The Ex-President.

Mr. A. Cooke proposed a hearty vote of thanks to the retiring President; remarking that every member appreciated the work he had done during the past year.

Mr. J. A. Harris (Wigston) seconded, and Mr. W. Langford (Longton) supported, the motion, which was heartily endorsed.

Mr. Vincent Hughes expressed his hearty appreciation. He did not think the year had been a useless one from the point of view of the Association. They had now revised rules which he felt would work to the benefit of the Association. There had been a lot of spade-work done in this direction; and he hoped as the years rolled on that the result would be to the advantage of their organization.

Mr. Cooke next proposed a vote of thanks to the Hon. Treasurer (Alderman W. R. Cooper, J.P.), and to the Hon. Secretary (Mr. Copp).

Mr. Vincent Hughes seconded the motion, particularly mentioning the arduous character of the Hon. Secretary's work.

The motion was very cordially agreed to.

Alderman Cooper, in responding, thanked the members for their kindness to him. He should still be pleased to do all he could for the old Association, in connection with which he retained many pleasant recollections.

The Hon. Secretary, in thanking the members, said that the duties attaching to the office of Secretary were rather onerous; but he felt a pleasure in doing the work, providing the members would show reasonable enthusiasm and attend the meetings.

This concluded the proceedings; and in the evening the members dined together, with the President in the chair.

INCANDESCENT GAS v. ELECTRIC LIGHTING FOR RAILWAY CARRIAGES.

[COMMUNICATED.]

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THE introduction of incandescent gas lighting for railway carriages has brought the comparative merits of gas and electric lighting to an issue; and during the last year or so, a great deal of controversy has raged on this subject. Unfortunately, the combatants have usually been the makers of apparatus used in one or other of the forms of lighting, and their arguments therefore partizan, and not to be accepted unconditionally or without the comments of an expert who has a knowledge of both forms of illumination. The stock arguments of the gas or the electrical engineer on this matter are quite useless; for train lighting is a subject standing entirely by itself, and what would hold true in the case of ordinary domestic use is quite fallacious when applied to railway carriage lighting. An independent comparison at the present time, however, should be of rather particular interest to members of the gas fraternity, as their star would appear to be in the ascendant; and an inside knowledge of their opponents' arguments and tactics must always be of value. Might the writer also suggest that their assistance in promoting the use of coal gas would doubtless be appreciated by the railway companies, besides being of advantage to themselves?

The comparison between gas and electricity for train lighting divides itself very naturally into three heads: (1) Safety. (2) Cost. (3) Convenience. The first-mentioned consideration is very much the most important; but it was shown in the issue of the "JOURNAL" for Feb. 28, that the aspersions of electricians on the use of gas are without foundation, and that the one illuminant may be considered, for all intents and purposes, equally as safe as the other.

This being the case, the question of cost is left as the real heart of the controversy; for there is little to be said on the score of convenience. Railway companies are just now making strong efforts to effect economies; and there can be no doubt that the cheapest system of lighting will win, provided there are no outside considerations which bar its use. The General Manager of one of our larger railways only recently confirmed this view, when he said that, if the two illuminants were equally cheap to fit and to maintain, he would probably recommend electricity for use; but until this was the case, he felt bound to employ the cheapest—incandescent gas. In the past, there have been far too many unsupported and unproved statements made that this or that was the cheapest or best. For want of technical knowledge and experience, a number of railway managers have had to accept these statements; but there is no reason now why the facts on which the superiority of incandescent gas lighting are based should not be brought to light, and the truth vindicated, so that such mistakes shall not be repeated in future.

The best way to make a satisfactory comparison between the cost of the two methods of illumination would appear to be to take two similar coaches; the one fitted with incandescent gas, and the other with the latest form of electric lighting apparatus, and to ascertain the first cost of fitting them up, and then the annual cost of their upkeep. For our purpose, let us consider two modern corridor coaches. The gas-lighted one will be fitted with nine 30-candle power lights in the compartments, two in the lavatories, and five in the corridor—a total of 16 lights, or 480-candle power in all. The electric-lighted coach, by reason of the fact that 8-candle power lights can be fitted in the corridor and lavatories, will not have quite such a great amount of illumination, but should be well lighted. Each compartment will have two 16-candle power metallic filament lamps, which, with the other lights, will make a total of 344-candle power. Though this is less than the gas-lighted coach, it is a fair comparison; for the gas-lights in the corridors and lavatories are perforce almost compelled to be of greater brilliancy than is actually necessary.

The cost of fitting-up such a coach complete with storage cylinder, gauge, and incandescent gas-lights, is about £40. The annual upkeep cost works out somewhat as follows:—

Interest on capital (4 per cent.)	£1	12	0
Charging and cleaning	1	5	0
Maintenance and repairs	2	5	0
Mantles	2	8	0
Cost of oil gas	10	9	0
Total	£17	19	0

Were coal gas used (value £5 11s.), the total annual cost would amount to only £13 1s.

It is necessary to include in the annual upkeep cost of the gas-lit coach the wages and other expenses incurred in filling the cylinders with gas, and also in lighting the lights every evening. These items are, of course, not incurred in the case of electric-lighted stock.

It is estimated that the average railway coach is lighted for between four and five hours per working day. A few trains are run on Sundays, so that perhaps one-third or seventeen extra days should be added to the 313 days. Ten should also be deducted for time occupied in making repairs, &c. This makes a total of 320 days' use per annum. Five hours per day is probably on the high side; but in order that there may be no charge of preference, let us take the lighting hours at this figure, which gives us a total of 1600 per annum. Thirty-candle power is easily obtained from a consumption of 0·6 cubic foot of oil gas per hour. Each burner will therefore use 960 cubic feet per annum, to which must be added the bye-pass consumption, which is continuous, at the rate of 0·025 cubic foot per hour—*i.e.*, 213 cubic feet—making a total of 1173 cubic feet per annum. There being 16 burners, the consumption of gas for the whole coach will be 18,768 cubic feet, or, to put it in round figures, say, 19,000 cubic feet per annum. It is true there are systems of electric ignition on the market to-day which would enable the gas consumption through the bye-pass to be discontinued, and a saving of nearly £2 per year to be made; but as these systems have not yet been successfully applied to railway carriage lighting, we must in the meantime consider a bye-pass desirable—always bearing in mind that it will be done away with later on.

Oil gas, made in the comparatively small works possessed by railway companies—allowing a reasonable sum for depreciation, interest on capital, and other usual charges, including compression to 150 lbs. per square inch and distribution to the coaches—costs from 10s. to 12s. per 1000 cubic feet. For our purpose, let us take it at 11s. The value of the oil gas consumed will therefore be £10 9s.

It was explained in the article previously referred to that in all probability coal gas is likely to supersede oil gas in the near future. If coal gas were used, 0·9 cubic foot per hour would be required to give a similar light; while the bye-pass would use about 0·1 cubic foot per hour. Taking the cost of gas at 2s. per 1000 cubic feet (which is a reasonable average figure for the large consumption which would result), and allowing 9d. per 1000 cubic feet for compression and 3d. for distribution, &c., the total cost might come out at about 3s. per 1000 cubic feet. This being the case, coal gas to the approximate value of £5 11s. would be used if substituted for oil gas.

The sum shown for maintenance, repairs, &c., is an average gathered from the actual cost incurred by a number of companies over a period of several years; while the charge for mantles is reckoned at a cost of 3d. each, on an average life of one month, and though this is a decidedly lower life than is now obtained on many railways.

The numerous experiments originally made in electric train lighting have brought down the practical systems (so far as this country is concerned) to one—that is to say, that in which each coach is treated as a separate unit, and generates its own electricity by a dynamo run from a belt attached to one of the axles. For light when the coach is standing, a storage battery is carried; and surplus current generated is useful for charging this. It becomes evident at once that at least one complicated switch is necessary, and that the storage battery, for want of regular charging at a slow rate, is certain to be troublesome. This, indeed, is found in practice to be the case; and it will be seen that the cost of repairs and maintenance amount to decidedly the greatest charge in the course of a year. It is true that for the first few years the repair bill is generally low; but this happy experience is not continued. For this reason, it is always necessary to guard against accepting the figures furnished by any railway which has only had a short experience with electric-lighted stock. Such people generally find it amounts to (say) £4 or £5 per coach per annum for the first three years; but after this it invariably mounts up to from £10 to £16 per coach. The average cost per coach on different lines is a varying sum—that of one company being £10, of another £12, and of another £13, while with yet another it is £16 per coach per annum. The makers of electric carriage-lighting apparatus say the annual maintenance per vehicle works out at £4 to £5; and they even give certain railways as examples. On close inquiry, however, the previously given figures will always be substantiated; and the matter is really definitely settled by the refusal of the makers to entertain a maintenance contract at anything like the figure which they put forward. For present purposes, therefore, it is not unreasonable to take a mean of the costs incurred by the various railways, and say that £12 per annum is a fair figure to show for the annual repairs and maintenance of the electric lighting apparatus of such a coach as the one previously indicated. Replacement of the metallic filament lamps, of which there will be 25, at a net cost of 2s. each, and allowing for a life of 1000 hours, should amount to £4, going on the same lighting-hours basis as that of the gas-lighted coach.

It has been explained that the electric current is generated by a dynamo worked by the movement of the coach. It follows, therefore, that as work is being done the movement of the coach must to a certain extent be retarded, and it will require greater power on the part of the locomotive for haulage. The makers of electric train lighting apparatus have gone to very great pains to try to prove that the extra cost involved in the haulage of electric-lighted stock is infinitesimal. But every engineer knows that work is never done without someone paying for it; and it does not require much argument to show that the cumulative effect of even a trifle such as this is represented to be, when spread over thousands of carriages, is no longer small. From bench tests made with the carriage-lighting dynamos commonly in use, to ascertain the amount of power actually required to drive them, it has been definitely established that, translated into everyday terms, not less than 0·6 lb. of coal will be used for every mile a coach is run; and it must be remembered that this cost is incurred whether the lights are on or not, and during both day as well as night, all the time the coach is moving. From tests made under actual running conditions by various companies, this "theoretical" figure has been

very strikingly confirmed; for they show an increased coal consumption with electrically-lighted stock of from 0·45 lb. to 0·69 lb. per coach per mile. To assure oneself of the real nature of the additional resistance offered by electrically-lighted stock, one has only to question a driver who regularly works trains composed of both classes of stock. The man's reply, pointing out the extra pull required, is quite likely to be more forcible than polite. Drivers do not like heavy, or (what is the same thing) heavy-running trains.

For our comparison it will, therefore, not be out of place to consider that the extra cost of haulage of electrically-lighted coaches will amount to not less than 0·5 lb. of coal per mile per coach. About 150 miles per day is generally considered fair average work for a railway coach. In the course of the 320 days previously fixed, therefore, some 10 tons 16 cwt. of coal will be used for generating current—not to speak of other costs for extra water, oil, and wear and tear. With coal costing about 12s. per ton, the value of the coal used will be about £6 9s. 6d., which amounts to a really serious sum when it is applied to thousands of carriages. Statements which indicate a very different state of affairs to this are put forward by parties interested in the question; but if they are followed up with the railways from whom they are supposed to emanate, it will usually be found that the letters were written with insufficient information or before careful and lengthy trials had been made. In some cases, many published statements were made fourteen or fifteen years ago, when electric train lighting was first introduced.

The total annual cost of an average coach of the nature specified lighted by electricity is thus about—

Capital cost of fitting, about £120.

Interest on capital (4 per cent.)	£4 16 0
Maintenance and repairs	12 0 0
Replacement of lamps	4 0 0
Haulage	6 9 6
Total	£27 5 6

Summarizing the results obtained, we have the following comparison, which speaks for itself:—

—	Incandescent Gas.		Electric Light.
	Oil Gas.	Coal Gas.	
Capital cost of fitting = about	£ s. d. 40 0 0	£ s. d 40 0 0	£ s. d 120 0 0
Annual upkeep = about	17 19 0	13 1 0	27 5 6

A few of the points urged in favour of electric lighting of carriages may next be advantageously dealt with. It is stated that in some cases where two or three coaches are run together as a "set," one large-sized dynamo will provide light for all three, thus saving first cost and maintenance of two. In the first place, it must be remembered that, if this were done, a larger dynamo and larger batteries would have to be used, and these would cost more. Then, again, it is not every railway which is able to run carriages together thus in sets of two or three. Besides which, if anything goes wrong with the lighting, three coaches are put out of traffic instead of one, which would be a very serious matter. Altogether, though this arrangement is fairly extensively used on certain railways, it does not appeal to every company, nor is its application without drawbacks.

Other statements commonly made are that gas-lighted stock requires to be withdrawn from traffic for the charging of the cylinders; that the coaches have to be taken to gassing places, causing unnecessary mileage; and that the lighting and cleaning staff in the case of gas are not required with electricity. The first and second statements represent cases very seldom met with; for it is usual to gas coaches when standing in terminal stations, or when in the carriage sheds, and in either case it does not take long to fill the storage cylinder. As for the alleged extra staff required in the case of gas-lighted carriages, it is a doubtful point whether more men are required to attend to gas or electric lighted stock. In any case, it has been shown previously that, even if this should be so, gas is distinctly the cheaper illuminant.

It will be urged by electricians that our experience of electric train lighting has been hitherto almost solely confined to one type of dynamo and auxiliary apparatus, and, what is more, one having certain disadvantages. This is to an extent true; but let us consider the "Rosenberg" dynamo, recently introduced, which has many good points not possessed by any apparatus hitherto in general use. For instance, it is simple in design, and it does not matter which way it revolves, or at what speed. The output which it is designed to generate will be given, and no more, and always in the right direction. Further, by a simple arrangement, it will be possible to so arrange that, when no light is required and the battery is fully charged, the dynamo will run free, and cause no additional coal consumption. This facility may bring the cost of haulage down from about £6 to £2 or £3 per annum; and the simpler dynamo may also reduce the repair-bill. But though undoubtedly an improvement on existing apparatus, the whole thing is quite new; and it will be some years yet before really definite information will be available as to its behaviour in ordinary every-day use. Quite apart from this, however, there is not the slightest possibility of its reducing the cost of electric lighting below that of incandescent gas—particularly if coal gas is used.

It may be freely acknowledged that, for certain special purposes, such as in the case of sleeping-cars, or where fans require to be worked, as in many trains in tropical countries, electricity possesses advantages over gas. But it cannot be too plainly and definitely stated that, for ordinary requirements, incandescent gas lighting is just as good and convenient as, and, light for light, considerably cheaper than, electricity.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

Annual Dinner.

The Third Annual Dinner of the London and Southern District Junior Gas Association, which took place on Saturday evening at the Cannon Street Hotel, proved a very successful function; the arrangements of the Stewards (Messrs. J. G. Clark and P. J. Smithers) leaving nothing to be desired. Mr. L. F. Tooth (the President) was in the chair; and about fifty sat down—the party including, in addition to ordinary members of the Association, Mr. E. Pilbrow (an honorary member), Mr. A. H. Kelday, of the Commercial Gas Company, and Mr. E. W. Browning. The musical programme was much enjoyed; and there was some appropriate speech-making.

After the Loyal Toast had been honoured, the President proposed "The Association and Patrons," coupled with the names of Mr. W. J. Liberty and Mr. E. Pilbrow. He remarked that the Association was still growing; and the progress it made must in course of time bring beneficial results to the industry at large, as the members naturally became better fitted for the posts they occupied. He thought the work of the Association was recognized by the seniors, who would not otherwise extend as they did support and privileges to the members. Of the work done by Mr. Liberty during his two years of office, he could not speak too highly. Mr. Pilbrow, too, was always ready to hold out to them a helping hand; and the fact that he entertained the members at the Garden Club in the Japanese Exhibition last year, proved that he took a keen interest in the Association. Responding, Mr. Liberty expressed the firm conviction that the Junior Gas Associations had come to stay. Their own organization had gone on until it had met approval and praise; and the seniors regarded it as quite a necessary thing. He wished the Association, of which he was perhaps one of the sponsors, very hearty success. Mr. Pilbrow said that the success of the Association was due to the hard work the various Presidents had put into it. This year there was going to be a Coronation Exhibition at Shepherd's Bush; and he would be only too pleased to repeat his invitation of last year to the members to take tea with him at the Garden Club. He was glad to see Mr. Browning with them that evening, and would like to propose him as an honorary member of the Association. The toast of "The President" was entrusted to Mr. W. Upton, who remarked upon the great amount of hard work that had been put in by Mr. Tooth—which would set a good example (if one were needed) to those who might be coming along in course of time. The President said that he set out with the intention of doing his best; and to this resolve he had kept. In their home at the Westminster Technical Institute, the Association had every possible convenience; and they had much for which to thank the Principal (Mr. J. S. Ker). The only regret he had felt during his year of office was the loss of his colleague Mr. H. Rothwell. They would, of course, welcome Mr. Browning as an honorary member. Mr. S. A. Carpenter proposed "The Visitors," coupling with the toast the names of Mr. Browning and Mr. Kelday. He said the Association would be strengthened by the inclusion in it of Mr. Browning as an honorary member; while as to Mr. Kelday, they had had a very recent instance of his kindness at Stepney, and if it was possible for him also to become an honorary member he would be very cordially welcomed. In responding for himself and Mr. Kelday, Mr. Browning referred to the value of the Junior Associations, and remarked that it was just as important for the men who filled the smaller positions in the industry to be well trained as it was for the heads of the departments. He was honoured by the proposition that he should be made an honorary member of the Association, on the success of which he wished to heartily congratulate the members. He would at all times be pleased to do anything he could for them. The assistance rendered by the Technical Press to the Junior Associations was acknowledged by Mr. J. G. Clark; and Mr. D. J. Winslow proposed "The Secretary and the Treasurer," to which Mr. S. A. Carpenter and Mr. J. Hewett replied.

The Midland Junior Gas Association will next Saturday visit the works of Messrs. Parkinson and W. & B. Cowan, Limited, in Bell Barn Road, Birmingham. This meeting is in lieu of the annual general meeting, which will be postponed to a date to be announced later.

Illuminating Engineering Society.—The next meeting of the Society takes place at the Society of Arts, John Street, Adelphi, next Tuesday, when the discussion of the papers on "School Lighting," by Dr. J. Kerr and Dr. N. Bishop Harman [*ante*., p. 526] will be resumed. The chair will be taken by the President, Professor Silvanus P. Thompson, F.R.S.

THE GAS INDUSTRY: A RETROSPECT AND A FORECAST.

By T. G. Marsh, of Manchester.

[A Paper read before Society of British Gas Industries on March 3.]

It is not the object of this paper to follow the varying improvements in methods of manufacturing coal gas or in the utilization of its bye-products, but rather to deal with the commercial considerations that have affected the growth of the gas manufacturing industry, and to endeavour, from a consideration of the successes and failures of the past, to formulate a forecast as to the trend of future events, and, as far as possible, ascertain whether the limit of expansion in the gas industry has been attained.

The birth of the commercial life of the gas industry may be taken as commencing with the formation of the Chartered Company. This Company obtained its Charter about the year 1812, but not until after experiencing many delays attendant upon obtaining the consent of Parliament to their various schemes. Parliament did not at this time assess the future value of gas lighting at any great price—seeing that, to commence with, the first Bill applied for was lost, principally on the ground that the capital asked for (some half-million sterling) was deemed to be excessive. The first Charter gave permission for raising £300,000. In passing, one may note that the capital profitably employed to-day by the London Gas Companies may be taken as over £40,000,000.

For the purpose of this paper, the life of the gas industry from the date of the Charter of Incorporation of the first Chartered Company up to the present date is divided into three periods: The period of inception, the period of success and monopoly, and the period of stress and competition.

Inception.

During the first period, the engineering skill and organizing abilities of the leaders were fully engaged in combating the difficulties inseparable from most new undertakings, and almost insuperable in the case of the one under consideration. At a meeting such as this, the history is so well-known that it is not necessary to enlarge upon the difficulties and the ultimate triumph.

Period of Success.

In the second period, a well-merited success repaid the efforts of the past, and most of the investors received a fair return on the capital they had risked. During this period, the gas undertakings might be said to have enjoyed success even greater than had been dreamed of even by the original promoters. Then came the inevitable time when gas companies commenced "resting on their oars." This period is always part of every successful, non-competitive business. Those who were interested in the gas business drew their return and were satisfied. They had no fear of competition; they were a monopoly. The result of monopoly soon became apparent. The only class of customers at that time being those who desired light, and the demand for gas being great for this purpose, the Directors and officials adopted the take-it-or-leave-it policy. This policy appeared afterwards to be hereditary; and succeeding boards and officials held on by it. Disraeli has said that, "in a progressive industry, change is inevitable." The industry had ceased to be progressive; it abominated change, and became arrogant and independent. A consumer desiring to use gas for any other purpose than that of illumination received no assistance from the vendors of gas; he was looked upon as an undesirable creator of trouble. Certainly, something was required to influence the gas vendors in his favour.

Furtive attempts were now made to introduce the electric light. These were treated with contempt—scoffed at as a kind of joke. Nevertheless, the electricians, full of the enthusiasm and energy of youth, made rapid progress; and ridicule was changed to fear. A panic set in, stocks went down, and a change came over the scene. It had been well to retain the good they had. It had been thought good policy to stay progress and take no risks. But now, alas! were they going to be ousted from the field of lighting obtained at great cost, and found so profitable? Many feared this. The passing years were marked by constant and remarkable improvements in the electric light industry, and but few in our own. Inventors of gas consumers' appliances had been disheartened by the want of co-operation shown by the gas companies, and by the open hostility frequently exhibited.

The leaders of the industry now opened their hearts to the inventors. They were asked to bring forward of their best, and it would be favourably considered. Herr Auer von Welsbach introduced the incandescent gas-burner. After a considerable time devoted to experiment, this light became a great success. Gas undertakings did their utmost to encourage consumers to instal it. It was a means of fighting their strong opponent, the electric light. The inroads made upon their consumption by this burner were not at the time particularly noticeable. Gas undertakings were obtaining new customers at a rate unprecedented in the industry. These customers were of the artisan class. The gas sold to this class of people balanced the loss in consumption due to the economy of the incandescent light. As time passed, however, the country became very largely saturated with slot gas-meters, and practically the whole of the artisan class had been made users of gas. This will be better understood when I mention that in the year 1890 the number of gas consumers in the United Kingdom amounted to 2,297,273; while in the year 1910, the number of consumers was 6,501,273 (say, 6½ millions)—an increase of almost 300 per cent.—the number of slot consumers being 3,084,503 (over 3 millions), showing that the artisan class have come forward in tremendous numbers.

The progressive spirit that had been raised by the competition of electricity had thus benefited the working class in giving them a cheap, safe, and cleanly light; while the gas companies had by these customers been shielded from the loss in consumption which would otherwise have overtaken them. About this time, manufacturers of gas-engines approached many gas companies with a view to obtaining from them special concessions, on the ground that the gas taken by them would level-up the load of the gas companies, and was, consequently, much more profitable than gas sold for ordinary lighting purposes.

Most of the engineers in charge of gas undertakings were anxious to meet this demand liberally. Unfortunately, however, gas committees and boards of directors had to be consulted. The members of these (in what is admitted in many towns to-day as being a short-sighted policy) refused to enter upon any scheme of differential rates. The result of this was that gas-engine makers resolved to become independent of the various coal gas undertakings. Suction plants came on the field, and with them came offers from the beforetime obdurate gas undertakings of differential prices. Most of these offers, however, were of a half-hearted type, and did little to stay competition. The use of gas power derived from ordinary coal gas has, therefore, not increased in anything like the proportion which might reasonably have been expected, and which certainly would have been the case had a business-like and generous policy been adopted.

Stress and Competition.

Gas manufacturers were now faced, not with one competitor, but with two. They had the electric light fighting for a share of the lighting business, and suction-plant manufacturers determined to have a share of the power business. Something must be done; the industry must not be allowed to stagnate. The artisan class were again approached, and small cooking appliances were fixed, in many cases free, or at a practically nominal charge for rental. A diminution of sales was by this means once more averted. To-day, however, saturation point as regards cooking-stoves is being very quickly approached; and the question for the industry is: Has the limit of progress been attained? Engineers and managers of gas-works reply: No; decidedly not. If so, then what is required is a business-like commercial policy; and that policy was very tersely foreshadowed in the "Journal of Gas Lighting" some little time ago, and should be taken into serious consideration. It is as follows:

> There is a scramble for business in lighting, heating, and power between a number of very keen competitors; and prices, in each line of business must be governed, not by the policy of a past day, but by what the competitors of town gas—whether coal, suction, and other producer gas, or electricity—can, or do, offer.

At the present moment, the atmospheric conditions of almost all large towns in the country is giving cause for serious thought to scientists and medical authorities. Unfortunately, however, these gentlemen appear to be the only people who are at all disturbed. In many towns it has been pointed out to the municipal councillors that black fogs are caused by smoke from domestic chimneys, and that the only practical remedy is the gradual extinction of the use of coal—replacing it by gas or electricity.

Our friends who are connected with gas undertakings point out that the cost of heating our houses with electricity is altogether prohibitive. At the moment, this is so. But each year brings improvement, and decreases the cost; and gas committees must not forget that our electrical friends strongly point out the advantages of differential prices, and, by diagrams and figures, they proceed to prove, to the satisfaction of themselves and their committees, that it is possible to sell their commodity at less than cost price for certain purposes, and then, by reason of the levelling and increasing of their load, show an increase in profits at the end of the year.

Now, gas men cannot reasonably object to fair competition; but no municipal trading committee has a right to enter upon reckless and hazardous trading, and when competition is of such a character it should be brought strongly before the ratepayers. I will give instances of this objectionable trading. A corporation look with envious eyes on the profits of the local gas company. They feel like buying it, but not like giving the market value. They instruct their electric department to give current at a lower rate to consumers who will undertake to entirely dispense with gas. This is not honest trading. I will give another case I have come across. The electric department endeavours, by similar means, to boycott the gas department—two branches of the same business competing, one actually endeavouring to wreck the other by secret agreements.

Bernard Shaw remarks that one of the advantages of municipal trading is that municipalities do not become bankrupt. He might have mentioned that the misdeeds of the councillors were covered up, and the ratepayers paid the penalty. On the one hand, we cannot object to differential rates, but, on the other hand, we should certainly draw the line at boycotting. I believe that the differential-price system should be adopted by gas undertakings

and electricians alike. In the case of the gas man, the price of sale should be differentiated in favour of those who use gas for heating purposes and for power.

Certain towns in our country are able to sell gas at 1s. 4d. per 1000 cubic feet all round. Then, surely, most gas undertakings in the country can afford to sell their increased load at something approaching this figure. At 1s. 6d. per 1000 cubic feet gas would be slightly dearer, on the average, than coal for the purpose of domestic fires; 1 lb. of coal being equal to about 5 cubic feet of gas. At this price, gas-fires and gas-heating appliances would, in course of time, become as generally used as gas-cookers are now. When the cooker was originally introduced, there was a great prejudice against it. This prejudice was broken down by continual effort; and to-day we should have difficulty in coming across the householder who professes to be able to judge whether viands were cooked by gas or by coal, though in the past such prejudiced critics were to be found everywhere.

The general introduction of gas-fires is an even more difficult matter than was the introduction of cookers. There is the same conservative spirit, and the same prejudice to be combatted. Fires have, during the last few years, been improved in efficiency, and, from a sanitary point of view, meet all the requirements of health. But there is another, and even stronger, prejudice than the hygienic one, and that is founded upon the solid basis of £ *s. d.*

Now, what I am suggesting in this paper is that lighting gas should retain its old price, and that, for the purpose of fires, and for heating generally, there should simply be a nominal margin on the absolute cost of the gas. I am prepared to say that the adoption of this principle would certainly mean in most towns an increased profit to the gas undertaking at the end of the year. The fixed charges and sinking funds would remain, at any rate for a period, at the same figure; and as the make increased, the load being regular, the amount charged on these accounts against the gas would be less per 1000 cubic feet. I am satisfied that most towns in the kingdom could increase their sale of gas by 33⅓ per cent. in a period of three years. This would mean a reduction in the sinking fund per 1000 feet of gas of almost one-third—not simply upon the gas sold at the reduced prices, but upon the whole make of the undertaking.

Had gas been introduced in the early years of gas manufacture for the purpose of heat and power alone, I venture to say that it would have been sold now at a maximum price of 1s. per 1000 cubic feet; the capital charges would have been so much less upon the make (which would have been almost constant); and gas would have been taken regularly throughout the whole of the working hours of the year. This point was conclusively dealt with in a paper read by Mr. Meunier on Feb. 25, 1905, when he showed that differential prices should not be arranged to meet the desires of large consumers using the gas for lighting, as the expenditure on their account was in many cases very much greater per 1000 cubic feet of gas sold than that for smaller consumers who used light for domestic purposes—the hours of lighting in mills being very much less per annum than those of the domestic house.

It is not, however, so far as municipal gas authorities are concerned, the fault of either the engineer or the committees administrating the gas department that we still await differential prices arranged on business principles. They are to a certain extent governed by outside opinion; and, as I have already said, the ordinary citizen takes very little cognizance of matters connected with the sanitation of the town in which he resides, while the minority, mostly composed of members of self-elected ratepayers' societies and compounders for the payment of cottage rates, can be heard on every opportunity stumping the district. These gentlemen desire to have what they term a reduction of the rates. They do not see anything further than the fact that they are at present receiving their £30,000, £40,000, or £50,000 a year from the gas department, and are afraid of risking a reduction in the amount. This amount is being found by the gas consumers.

Many of these ratepayers' association members are not gas consumers, and are pleased to see the way the rates are shifted to other shoulders; the amount obtained from the gas department being looked upon by them as a clear profit to themselves. These gentlemen are mostly owners of cottage property. They compound for rates, and charge an extra rent in consequence; and it is very nice and convenient to get the gas consumer to pay a portion of this rate in addition to drawing it from the tenant—a clear profit. They, however, do not grasp the fact that gas sold at cost price for heating purposes would reduce the expenditure of the citizens to a much greater extent than the 4d. or so in the pound taken from the gas department.

As a case in point, I may mention a town where the rates are reduced in this manner, while the expenditure in street cleaning, redecorating, and repairing the ravages caused by black smoke is not less than 15s. per head of the population per annum. It will, therefore, be seen that they are paying very dearly for the amount misused in subsidizing the rates. This is what might be termed a penny-wise-and-pound-foolish policy; and I would ask these gentlemen to go fully into this question, and cease clamouring for gas profits. It is nothing less than a calamity to the nation that our atmosphere should be polluted by soot and acid. The degeneration in town populations is very largely due to this pollution. From a commercial point of view, it is also a calamity to the nation that a raw product available in almost unlimited supply—a product of the greatest value for fertilizing our land—should be wasted. The abolition of domestic chimney smoke, and the replacing of coal by gas, a smokeless fuel, would mean a production of ammonia and tar of an annual value in profit of not less than an amount sufficient to pay the interest on the National Debt. So great and crying is this evil of the smoke nuisance, that it is deserving of the attention of the Chancellor of the Exchequer; and I would suggest to him the taxing of all chimneys connected with coal-fires.

A short period of black or yellow fog increases the death-rate from chest complaints in such a manner as to cause the greatest uneasiness to medical officers of health. The well-to-do citizens of large towns live a considerable distance from same, for reasons of health; while the working class and artisan populations are compelled to stay in the smoke and smother. It is this that is the predominant cause of the degenerate stamina of the rising generation; it is this that causes our consumption hospitals to be full of patients. Medical authorities advise that the windows and doors of our houses should be kept open, that we should live in a free current of God's pure air. But how can this be done in congested districts? How can windows be kept open where the air is thick with carbon and noxious acid? Apart from the hygienic side of the question, the financial side looms black; and it would be well for those members of ratepayers' associations who look upon £ *s. d.* as the chief factor in life to consider this. If they do so with the same careful attention that they give to their other financial arrangements, we shall shortly have these gentlemen clamouring for gas at a cheap rate for domestic heating and warmth.

In forecasting the future of the gas industry, figures that I have carefully gone into show that the amount of domestic coal used in our households is 56,000,000 tons, and the amount of coal gas that would be requisite to replace this fuel would be 627,200,000,000 (say, 627 thousand million) cubic feet. Therefore, as the total make of gas at the present time in the United Kingdom is 199,000,000,000 (say, roundly, 200 thousand million), it proves that the field for the enterprise of gas manufacturers in supplying domestic requirements alone is at least three times the amount of the present entire make of gas in the kingdom. Now, seeing that of all the industries in the kingdom gas enterprises have certainly been the steadiest and most reliable, there should be no possible room for pessimism as regards the future scope with such a market in view. The difficulty to be contended with is the slow and non-progressive policy persisted in in many directions. There can be no doubt that in the near future either the electrician or the gas-man will find means of entirely displacing coal in our houses. It remains with you gas-men to say which shall have the profit and the credit of such a revolution—the gas or the electric light undertakings.

Discussion.

The PRESIDENT said they had all listened with great attention and interest to the paper. Personally, he could not offer any very useful observations on the subject Mr. Marsh had brought before them. But he was competent to verify the historical particulars at the beginning of the narrative. He certainly remembered the days of stagnation and self-satisfaction. He remembered, too, the day when he was lecturing in that city on the uses of coal gas; and when a man occupying an important position in the public life of the city said, in relation to some remarks he (the President) had made about the possible developments of electric lighting, that no man in the audience would live to see the days of electric lighting. He remembered the days also when one could find fish-tail gas-burners which had been unintermittently in use for thirty years without any attempt to relieve the situation except by pouring abuse upon the incompetent gas companies. He could go through the whole narrative. But the days of stagnation and cocksureness had passed; and all were now imbued with the importance of doing everything that knowledge of business could suggest to carry forward the industry with which those present were surrounded. Though there was now no cocksureness and self-satisfaction, there was confidence; and he ventured to think that confidence was not ill-founded. Whether or not this was justified in the future must depend upon attention being paid to many of the points that had been brought forward in Mr. Marsh's paper. One thing in the development of their enterprise that was of great importance was the attention that must be paid to the education of the consumer in the proper use of the fuel employed. Much of the trouble that there was arose from the incompetence of the people who used the commodity supplied. One way in which this was to be counteracted was by the gas suppliers taking upon themselves a more complete and elaborate expert attention to the consumers' appliances.

Mr. H. J. YATES remarked that the paper was full of many useful points that could be discussed. One might, for instance, go into quite a number of figures and facts with regard to the differences in cost between gas and electricity, particularly with reference to gas-fires. They must not rest easy with regard to electricity. It was going ahead by leaps and bounds; and things that one heard from day to day were almost disquieting. Considering the position that gas people as a whole had placed themselves in, they would be well able to meet any competitor who came along. When one came to consider the number of British thermal units there were in a unit of electricity, and the number of British thermal units there were in (say) 100 cubic feet of gas, they could see where they were; and they could see why gas should be sold at as low a price as possible.

Mr. ALEXANDER WILSON, President of the Institution of Gas Engineers, said he had listened with pleasure to Mr. Marsh's

paper, which had put before them, in Mr. Marsh's own characteristic way, ideas which were very present in their minds at this time. The future of the gas industry was no doubt bound up in a great measure with the use of heating and manufacturing appliances, and more so than in the question of lighting. In the beginning of the paper, Mr. Marsh spoke of the industry's period of inception, the period of monopoly and success, and the period of stress and competition. It was his (Mr. Wilson's) opinion that this period of stress and competition would lead to a period of still greater success in the future. A great deal was being said at the present time about the steps taken to put the uses of the various gas appliances before the consumers. In corporations, there had been a deal of trouble in getting for this important matter the consideration desired. A great many interests besides the gas department were affected, or at least were supposed to be affected. They had ironmongers and plumbers all wishing to keep corporations from doing what they ought to do in the way of bringing gas appliances before the gas consumers. He himself had tried for several years to get this question dealt with in a fair way by those in authority, but had had great difficulty in doing so until quite recently. The Association of Plumbers and Ironmongers opposed them strenuously whenever the question was brought up in the Corporation; and they were generally successful in getting the proposals of the Gas Department put back, or dealt with in such a way that they were practically muzzled in their business. He was glad to say they were entering upon a new era, in which he was very hopeful of obtaining much better results than ever before. They were trying to carry the tradespeople with them as far as possible, and to give them a fair chance of saying whether they would help them. If they would not help, and help in a proper way, the Gas Committee were bound now to go forward themselves. There were immense possibilities before the gas industry in regard to gas-heating appliances for all purposes. So far as their knowledge went, he thought he was safe in saying that gas heating for domestic purposes offered the only practical solution of the difficulties of coal heating. The matter of smoke abatement had been taken up in Glasgow. A Committee had been appointed; and they were dealing with the question in a whole-hearted manner. They would, he thought, obtain a good deal of benefit through this Committee; and the Gas Department were lending them all the assistance they could. Mr. Marsh had spoken of the question of subsidizing the rates from the profits of municipal gas undertakings. In Glasgow, he was glad to say, they were free from this. They had never in their city adopted this policy; and when the Corporation were in Parliament last year, Parliament took good care it should not be adopted in the future. He did not think any of them in the Gas Department were at all sorry about this. Some people seemed to think they had a right to take from the gas consumers the wherewithal to subsidize property owners and people who used the electric light. No doubt in the future it would be seen that the policy applying in Glasgow was the right one to follow. In many of the large cities and towns of England, the rates were subsidized from the gas profits. He thought the Glasgow way was the right one; and time would, he believed, confirm it. As Mr. J. G. Newbigging had said, the rates ought really to subsidize the gas undertaking, in order to do away with the smoke nuisance. Anything that was going to help forward the use of gas, and give a bigger output, was sure to assist gas undertakings, and this would benefit gas consumers.

Mr. F. J. West said he looked upon Mr. Marsh (he did not say this out of any disrespect) as a man who bristled with arguments; and his paper, he thought they might say, bristled with points. In a short compass, he had got into it smoke abatement, the question of differential rates, the subject of selling gas at cost price, and the question of unfair competition between different undertakings of a municipality. In his remarks on unfair competition between a gas and an electricity department, he rather thought Mr. Marsh was getting at him (Mr. West). He happened to be on a Committee representing the Manchester Electricity Department; and as most of those present were aware, there had been a controversy between the Electricity Department and the Gas Department. The former department, in their defence, had argued that they were quite justified in extending their business by creating a power load, and they only contributed to the rates an amount that represented just 1 per cent. on the outstanding debt. The amount they did contribute was equivalent to a ¾d. rate. The amount that the Gas Department contributed was something like £60,000 a year, which was equivalent to a 3½d. rate. On this difference one trouble arose; and he did think the Gas Department never had a better argument than at the present time for selling gas at practically cost price. If they looked at this matter from the respective points of view of the ratepayer and the consumer, it worked out in this way: If gas was reduced in Manchester by 3d. per 1000 cubic feet, and they had to find the sum of £60,000 in the shape of an increased rate, on the rateable value the difference would be something like 3½ to 1—that was to say, if the gas was reduced by 3d. per 1000 cubic feet, it would mean (these were not exact, but only proportional figures) to the users of gas £3 10s., as against £1 if they raised the £60,000 or so by way of additional rate. It would be seen from this that, in providing from the handsome profit of the gas undertaking the large sum they did for the rates, the gas consumers paid out of all proportion towards the city's expenditure, compared with the large portion of the ratepayers who did not use gas at all, or who employed the electric light. The position in Manchester was comparable with what obtained in many other towns. And it simply meant that, if gas consumers were to have fair and proper treatment, the price of gas would have to be considerably reduced. They should at any rate sell at such a price that gas should only give the ratepayers the same interest as electricity. He asked Mr. Marsh if he had had any discussion with users of gas or ratepayers as to the attitude they would adopt with regard to differential prices.

Mr. J. W. Broadhead observed that he took it the essence of the paper was the differential price of gas. This was a subject that Mr. Marsh had much at heart; and a subject on which he thought he had an axe to grind. But from whatever standpoint they looked upon this question, they could thoroughly and sincerely agree with the proposition he had raised. He (Mr. Broadhead) entirely agreed with his views on the subject. As a business man, he could not understand anybody who had a monopoly of a certain commodity, and held the field from the point of view of cheapness, reducing his price all round. Such a reduction was generally small; and he did not think that it directly gained many new consumers. Things would be very different if the reduction was confined to reducing the price for heating purposes. As a manufacturer of gas plant, he should be pleased when the day arrived when gas-fires became more prevalent. The more gas that was consumed, the more would be the gas plant that would be required.

Mr. George Helps said he was strong on the question of differential prices, because he put them into practice five years ago; and they had been, so far as Nuneaton was concerned, their salvation. The ordinary price charged for gas was 3s. 6d. for lighting; and he did not believe they would sell a single foot more gas for lighting if they reduced the price to 2s. 6d. They therefore looked to power and consumption other than that of lighting. For power they sold gas at 1s. 6d.; and for cooking and purposes other than lighting, at 2s. The result had been that the profits had gone up; and the balance-sheet was better. It was not a bit of good sitting there, and talking of the cost price of gas. The cost price of gas was a complex quantity. If they saw by their accounts that the business had improved, surely that was good enough for anybody. He thought they should all thank Mr. Marsh for bringing this paper before them. It was one of the most interesting papers he had heard for a year or two. He was particularly interested in the sentence in which Mr. Marsh said: "Had gas been introduced in the early years of gas manufacture for the purposes of heat and power alone, I venture to say it would have been sold now at a maximum price of 1s. per 1000 cubic feet." He (Mr. Helps) thought this statement gave them a fresh direction for thought. There was nothing like looking at these matters from a distance; but it had never occurred to him before that they could look at the question of the distribution of gas in this way. It was rather a tall order that, if they had done this, they would be selling gas now at 1s. There were engineers in high places who laughed and scoffed at this. But the whole matter was what could other people supply light, heat, and power for; and they as gas suppliers had to come down to that, or go out.

Mr. R. G. Shadbolt pointed out that Mr. Marsh was all right in his paper until he began to prophesy. He imagined that if the order of things had been reversed, and the gas industry had approached its duty from the end of heating and power, that it would now have been supplying gas at a maximum price of 1s. per 1000 cubic feet. He (Mr. Shadbolt) ventured to say that, if the man in the street heard that statement, he would say, "well, why cannot you do it now?" Mr. Marsh might possibly favour the gas industry on some future occasion with advice as to the manner in which gas could be sold at 1s. per 1000 cubic feet. It was a beautiful ideal at which to aim; but in this particular he was afraid the artist had drawn hugely upon his vivid imagination. There was one factor in regard to this increasing of the load or levelling the load. Let them take for a moment a gas-works the demand upon which amounted to three-fourths of its producing capacity, he could then understand the strength of Mr. Marsh's argument that they might supply the remaining 25 per cent. of the gas at almost, if not quite, actual cost price, and that in this way the standing charges would be reduced over the whole. Then eventually when the demand was raised to such an amount that an enlargement of the entire plant had to be considered, where would the capital charges be if the price had been brought too low? Then they would have to start *de novo*, and wait again until they got to their maximum. There was an amount, and a minimum amount, of profit which local conditions must to a great extent decide, and which everyone must have in view, lest he be rushed into something that might literally become a tax upon the remaining custom. They complained of their competitor selling electricity at less than cost price, and they pointed out that the competitors were doing an injustice to them, and to some of their own customers. There was a minimum price for gas which they must each decide for himself. If they went below the minimum, it was wrong economically. There was a remark in the paper with regard to the cost per head of the population for the repair of the ravages caused by smoke and so on. If the 15s. mentioned was true, then it was one of the finest of arguments for the Smoke Abatement Society to use. Concluding his remarks, he said, if the maximum amount of efficiency was to be provided for gas consumers, every branch of the industry must combine to work together to that end.

Mr. J. H. Brearley observed that he should like to adopt differential prices if he was assured that no anomalies would arise therefrom. In his district, they did make a difference with respect to the price of power. There were sound arguments in favour of

this, because the power load was a load for 50 or 52 weeks through the year, and the load was practically equal in a summer week as it was in a week during the winter. But it was different when they came to the question of gas-fires. He had been looking up a table of temperatures; and he found that in Huddersfield last year, there were only thirty weeks when the mean temperature was under 50°. They knew from experience that gas-fires were not lit if the mean temperature was above 50°. This would mean that for twenty weeks in the year the whole of the plant that was used for manufacturing gas for gas-fires would be absolutely standing; and this confirmed what Mr. Shadbolt had said, that it was all right so long as they had 25 per cent. excess capacity. But when they had exhausted the 25 per cent. then capital troubles were going to begin if gas was sold for fires at too low a price. He was one of those retrograde individuals who had advocated the reverse of the policy of differential prices—that was, uniform prices. But perhaps he need not worry, because now their net price in Longwood was 2s. 6d. less 1d., which almost approached the differential price to which Mr. Helps referred—viz., 2s. He did not himself see why they should sell gas for heating to the man who used electricity for lighting, as was done in a neighbouring town to his, at 1s. 6d., and charge the man who lived next door, and used gas for both lighting and heating 1s. 6d. for heating and 2s. 6d. or 2s. 5d. for lighting. He was actually using a greater quantity of gas, and at a bigger average price, than his neighbour; and he (Mr. Brearley) did not consider this was equitable trading. Now with regard to electrical competition, so far as electric radiators were concerned, he did not think they need be afraid of them. If they utilized the whole of the heat units available in a unit of electricity for heating, they would only utilize as much heat as could be obtained if they employed the whole of the heat units from 7 cubic feet of gas. They could get 80 per cent. efficiency from gas-fires; so that they utilized a good portion of the 7 cubic feet. They obtained 50 per cent. in radiation, 30 per cent. of convected heat, and 20 per cent. went up the flue—an advantage that was denied to electric radiators. He thought if they emulated the electricians in their tariffs, and proposed to sell gas for heating at 25 per cent. off their lighting prices, their directors would think they had gone stark, staring mad. Another point was that they ought to get architects to design houses so that gaseous fuel might be used successfully. This was one of the greatest problems they had to face; and he hoped the Society would take it up at an early date.

Mr. Marsh, in his reply, said he was pleased to hear from Mr. Wilson that in Glasgow no margin of profit was taken in aid of the rates, and also that they were pushing forward the use of gas-fires so as to avoid the black smoke from domestic chimneys, and that the utmost endeavours were being made to introduce gas for power. It was pleasing to think there was one town in which the gas undertaking was owned by the municipality where the ratepayers were not parasites on the gas consumers. It had been said that his paper bristled with arguments. If all his ideas had been opposed that day, instead of having been so largely seconded, he would still have bristled with arguments. He spoke of the opposition that he had met with in pushing slot-meters in the early days, and contrasted the present position. To those gentlemen who now said that the time would never come when gas would be sold almost universally for heating at 1s. and for power at 1s. 6d., he replied that it would come. That was his opinion; and he believed his opinion was fixed on very reasonable grounds, which he would possibly at some future period fully explain, time not permitting on this occasion. One paragraph in his paper had been referred to by several speakers. It was the one in which he alluded to what might have been had gas been originally used for heating and power instead of lighting. Some of the speakers had stated that differential prices were not fair, and that the differential charging of two prices for one article was not business. This might not be their idea of business; but it was absolutely necessary. Had gas been originally made and sold for heating purposes, the capital of a gas undertaking would not have been one-sixth of what it was to-day. Had gas been made and used for heating purposes (say) for thirty years, then no doubt some inventive genius would have arisen and said: "I can use this gas for lighting; and I am going to light (say) my cotton mill or some other place with it." Mr. Broadhead put it that the question of differential prices was the *crux* of the paper. Certainly it was. He had an axe to grind when he was persuading people to use slot meters; and he had an axe to grind now. The man who had no axe to grind was generally an ignorant, an indifferent, and a negligent individual. The axe he had to grind now was simply that differential prices would be of great service to the gas industry, and for himself personally—he would admit, very considerably so. He had been asked by Mr. Brearley what would be the result on capital if gas-fires did this, that, or the other thing, by letting people have the gas at a lower price. They had to consider gas heating in relation to the cost of other forms of heating. The introduction of the incandescent burners, low and high pressure, had made a difference in the consumption of gas for lighting—in some individual cases, up to as much for instance as 75 per cent. This had to be made up. By doing what he (Mr. Marsh) suggested, a big load would be obtained, and it would put the greater part of gas plant to better use than it was put to now. When the limit of capacity was being reached, and fresh works had to be constructed, then they could discuss again how to make up a further big load to bring in the necessary return. The gas industry was not stopping short; and its recuperative power had been shown to be great. His (Mr. Marsh's) own objection was that gas-fires were not now used constantly. They were simply, in domestic life, used occasionally. The ordinary householder would not employ gas-fires for a dozen hours a day, and day after day, with gas at 2s. 6d. or 3s. per 1000 cubic feet, despite the saving in labour and so forth. He would not do so himself. He had six or seven gas-fires in his house. They were employed casually; but in the room that was continually in use, he was going to stick to coal until the Manchester Corporation supplied him with gas for heating at 1s. 6d. per 1000 cubic feet. [Mr. Marsh was unable to reply to all the points of the discussion, owing to the lateness of the hour.]

Mr. W. J. Jenkins, in proposing a vote of thanks to Mr. Marsh, said he had done a remarkable thing, in drawing plenty of gentlemen from the gas-engineering branch of the profession to speak, and so preventing, through want of time, members of the Society from putting forward their side of the question. It had no doubt been interesting to the gas engineers present to hear Mr. Marsh's paper, because it gave a side of the question from one who was not immediately engaged in the business of gas supply. The members of the Society were not, as were their visitors, tied down (and they sympathized with them for it) by Acts of Parliament in their competition. They were not troubled by ratepayers, nor by a good many things that their friends the gas engineers had to consider. The paper dealt largely with the smoke nuisance; and it was interesting to observe that where the smoke nuisance was greatest, the price of gas was the lowest. He might instance Sheffield, where the price of gas was not far off 1s. per 1000 cubic feet. One was apt to get more conservative as one grew older, and perhaps more pessimistic. It would be good for them all if they would think what things would be like if the atmosphere was in the pleasant state that Mr. Marsh foreshadowed, when everybody would be optimistic, and the difficulties that presented themselves to the gas-engineering profession would disappear. They would all be anxious to reduce the price of gas, and overcome the little difficulties that at present beset them.

Mr. Hugh F. Wright, in seconding the proposition, asked Professor Smithells to impress upon the students in the architectural department of the University the importance of making due provision in their designs for the use of gas-fires.

The motion was heartily agreed to.

GAS-FIRES AND THEIR FIXING.

An excellent attendance of members of the London and Suburban Ironmongers' Association, at the Holborn Restaurant, W.C., last Thursday evening, followed attentively a lecture by Mr. H. H. Creasey, of the Gaslight and Coke Company, on the practical subject of "Modern Improvements in Gas-Fires and Gas-Fire Fixing." The lecture was the first of a series which is being arranged for by the Association; and at its conclusion, the invitation of the President (Mr. E. H. Hill) to the members to put questions to the author, was freely responded to.

By way of preface, Mr. Creasey pointed out that his experience of gas-fires commenced something over twenty years ago, when he became engaged in the work of fixing them as an employee of the Gaslight and Coke Company. Since then he had constantly dealt with them in his positions of assistant inspector and inspector; and during the past three years he had been concerned practically exclusively with gas-fires, assisting Mr. F. W. Goodenough, the Controller of the Sales Department of the Company, in his successful attempt to remove the prejudice against them which was at one time so largely felt by members of the medical profession. He said the "successful attempt," because the Gaslight and Coke Company had now upwards of 2100 members of the medical profession in the portion of London which was supplied by them who were known as using gas-fires; and numerous quite unsolicited testimonials had been received which showed what a great change had taken place in the opinions of doctors on the subject of these appliances. The number of 2100 which he had mentioned constituted a proportion of 55 per cent. of the 3800 doctors who resided in the Company's area of supply. No doubt many of the remainder also used gas-fires; but they had not so far communicated with the Company on the subject. Doctors were, moreover, increasingly using them in their own, and ordering them for their clients' bedrooms, and even children's night-nurseries—showing they were quite satisfied that a properly constructed and ventilated gas-fire was perfectly hygienic. Many years ago the convenience, &c., of gas-fires was admitted, but not their hygiene and economy; and he thought they owed thanks to the makers for improvements carried out in recent years from the hygienic point of view, because he was quite sure that, with the old type of fires, it would have been impossible to satisfy the majority of medical men. It was only fair to state, too, that some ironmongers who had a gas-fitting department were fitting gas-fires before the gas companies (or at any rate the Gaslight and Coke Company) undertook such work; and a great deal was owing to these and other pioneers. The Company had greater facilities now for ascertaining what was right or wrong with fires; and they were always willing to give advice to ironmongers.

Being of opinion that, in order to properly appreciate the improvements in modern gas-fires, it was necessary to first touch on the faults of the old ones, the lecturer proceeded to deal with this

portion of his subject. There were, he said, five important things in the construction of a gas-fire: (1) Artistic appearance. (2) Accessibility and simplicity of parts. (3) Cheerful appearance when in use. (4) Hygienic efficiency. (5) Heating efficiency. The two last must not be sacrificed to attain the others; and although there might come a time when the price of gas would be so low that the heating efficiency would not be as important as it was now, hygienic efficiency must never be sacrificed for any purpose whatever, if they were to have the wholesale use of gas-fires which they so much desired, and which he was confident they would soon attain. Now, how did the old portable fires come out in relation to the points mentioned? As regarded artistic appearance, he thought he might condemn the majority of them; and he could also be as sweeping with reference to the accessibility of parts. In the matter of cheerful appearance when in use, the ball-fuel probably met with most approval; but the fibre fire was considered by many to be quite its equal. The iron fret fires he did not think were ever specially favoured for cheerful appearance. The heating efficiency of the fibre fire was not good; but it was his firm belief that, per cubic foot of gas usefully consumed, the potential heating efficiency of the best of the old types of ball and iron fret fires (especially the latter) was nearly equal to those of the present day. But it was heating efficiency of the wrong sort; and, moreover, the fires could not prove economical in use because gas was so largely wasted. As to the heating efficiency being of the wrong sort, what he meant was that there was too great a proportion of convected heat, and too small a proportion of radiant heat; and the convected heat was practically always given off at too high a temperature. Very few of the old fires could be truly termed hygienic; the reason being that the makers, in their efforts to obtain heating efficiency, were in many cases restricting the free passage of the products of combustion. The failure of the old fires to be perfectly hygienic was also due to the fact that the bunsen flames were broken up, owing to the irregular heaping-up of the fuel, which (except by careful fitters who saw the error, and took great care in packing) was practically thrown on, and frequently came right down on top of the burners. Moreover, the fuel was egg-shaped, instead of being hollow so as to go over the bunsen flame; and whatever care was taken, the flames must be broken up, with resultant imperfect combustion, and carbon monoxide escaping partly into the flue and partly into the room. Another trouble was the non-existence of suitable governors, so that a fire constructed to consume (say) 35 cubic feet of gas per hour, and carry away the products of combustion of this quantity, was frequently consuming 50 cubic feet and more per hour; and in consequence there were more products of combustion than the flue of the fire could deal with. Most of the flue-outlets were too small, or so badly placed that a quantity of the products baffled-back, instead of getting into the chimney. The makers here, again, were restricting their free passage, so as to increase the heating efficiency—always to attain the right end, but sacrificing the wrong thing to do it—and in case the flue outlet should by chance be sufficient to carry off the products the flue elbows supplied by the makers were frequently reducing ones, to again restrict them. Another error in construction was that the portable fires were made too deep.

As to the old burner-fires in grates, Mr. Creasey said the old finger-burner fire suffered from the fact that the fingers were not always scientifically constructed to obtain the correct mixture of air and gas; and unless the float was accurately spaced, the flames, instead of projecting through the gratings, impinged upon them here and there, with an evil result. The fuel, too, was thrown on haphazard, breaking the cones of the bunsen flames. Moreovcr, he had seen many of these and other types of burner fires with either no back-brick to radiate heat into the room or a very inadequate one. The iron burners, straight and curved, supplied by all makers were not altogether bad, and were still in use and being fixed in many grates, giving excellent results; but his Company no longer advocated this type of burner, owing to the fact that the 2 inches or so of iron which rested in the bottom of the grate made this part of the fireplace cold and dead—the actual fire not starting till (say) the first bar was reached. When it fired-back, as this type of burner was apt to do, the whole of the burner was affected, and got rapidly choked with carbon. There being no gas and air adjuster was also a drawback.

Coming to modern gas-fires, the lecturer remarked that the makers did not seem to hit upon any supremely important improvement until less than ten years ago; but things had moved fairly rapidly ever since. The first step in the right direction was when hollow, instead of egg-shaped, fuel was introduced; but even then few fitters knew how to pack a fire correctly—so as to allow each bunsen flame to travel up unbroken, inside the pieces of fuel. This was almost an art. He believed Messrs. Wilsons and Mathiesons, no doubt to get over this difficulty, were the first to start making the fuel so that one piece keyed into the other. This fuel was further improved by being lengthened into pillars, now so commonly used by all makers of portable fires.

About the same time, the makers, to meet the scientists' demand for a gas-fire to give more radiant and less convected heat, started making the fires with the back brick brought much more forward —in some cases having two rows of fuel only in front of the brick, and in others one. This undoubtedly greatly improved the radiant heat; and as the casting of the fire was necessarily shallow, the convected heat chambers were much contracted, thereby reducing the quantity of convected heat given off. The shallowness of the fire proved in the majority of cases more satisfactory to the public from the artistic point of view, as not spoiling the appearance of the fireplace so much. The experiment of bringing forward the back brick proving so successful, induced makers to adopt this system; and now nearly all the new types of gas-fires were made with a single row of pillar fuel in front of the back brick, which was led slightly forward at the top, similar to a modern slow combustion coal-grate, to increase the radiation along the floor, and at the various angles from the side of the fire.

Many people questioned whether there was any increase in the radiated heat given off by adopting this style of fire; but an experiment carried out by Mr. W. Fagan, the Manager of the Stove Department of the Gaslight and Coke Company, clearly proved its correctness, if proof were needed. His experiment was carried out with an old type of fire; and he brought the brick forward, using one row of pillar fuel only, and an extremely light set of bars. The experiment proved that the radiation was greater at any angle with the shallow fire than with the deep one. The temperature of the air leaving the surface of the convection chamber of the deep fire, was 168° Fahr.; and that leaving the shallow fire was only 142°—which was a distinct improvement. These results indicated that it was possible to make useful fires by converting those of the old type, so long as they were carefully fixed, and governed to prevent excessive consumption.

The latest types of fires were made with a very light set of bars, and in some cases with only a clip across the top of the fuel pillars to keep them in position; and some were made with absolutely no bars at all—the pillars being kept in their place by the shape of the brick, into which the upper portion of them engaged. These improvements again gave more radiated heat; it having been proved, by careful tests with a thermopile and galvanometer, that even a wire guard in front of a fire intercepted a certain portion of the radiant heat. Modern gas-fires would therefore give a far greater heating efficiency than the old ones, were it not for the fact that the loss of convected heat partly discounted the gain in radiation; and it was now being discussed whether the makers might have gone too far in the opposite extreme in throwing aside practically all the convected heat. He agreed with this to an extent, but suggested that if any more convected heat was to be given off than with the present type of fire, it must be pure and uncontaminated with the products of combustion, and at a somewhat low temperature—say, 140°, or thereabouts. It must be obtained without sacrificing in any way the hygienic efficiency of the fire. They must remember that there was only a certain percentage of the total possible heating efficiency of the gas that could be safely yielded by a gas-fire, because some of the heat must pass away in the flue gases to create the necessary pull to remove the products, for which purpose one must not depend on the average chimney flue. The fire must be capable of leading away its own products, without the assistance of a strong chimney pull. The man who fixed, or arranged to fix, the fire must deal with the question of whether the chimney was causing too much or too little pull on the fire.

Other improvements were the interchangeability of the parts of fires and the introduction of gas and air adjusters. Another good thing was the duplex tap. This was, of course, not a new thing; but in these days of wide-fronted fires, it was an absolute necessity. Then the greater width of gas-fires enabled one to heat rooms which in the old days it would have been impossible to do by this means. Dealing with fires to go into customers' own grates, Mr. Creasey said the only objection to all such arrangements was that, as the fuel and radiating brick were necessarily further back than in the portable fires, and there being no additional metal in front of the grate to give convected heat, a somewhat larger consumption of gas was necessary to produce the same heating result; and in some cases—more especially where the grate was an old and deep one—a larger proportion of heat went up the chimney than was necessary to clear the products of combustion. When he came across a case such as this, he usually fixed a sheet of uralite, which he supported at the bottom between the fuel and the brick, and then sloped it forward towards the canopy of the grate at the top, trying it at various distances until the correct position was obtained—allowing the products to get away, but greatly increasing the radiant heat. When the correct position was marked, it was easy to take the uralite out and drive a spike up in the chimney behind the canopy, on each side, for it to rest against, and then one each side in front. Or other methods might be adopted to make it a fixture, and to prevent rattling. If this was shaped and fitted well, and painted over with "Purimachos," it looked very nice, and almost similar to the slope of the back brick of a modern coal-grate. But, of course, care was needed not to overdo it and bring the top too near the canopy—checking the products getting away.

With the portion of the lecture devoted to the fixing of gas-fires, space will not allow us to deal. It may be remarked, however, that one point emphasized was that all fires should be fixed with a governor, though it was admitted that the risk of customers wasting gas was less with modern fires, owing to the height of the canopy above the top of the fuel, and the brick being so near the front, which made it possible to see the flames when they were unnecessarily high. In referring to the question of remedies for down-draughts and up-draughts, allusion was made to the paper which Mr. E. W. Browning lately read before the London and Southern District Junior Gas Association [*ante*, p. 308].

The lecture was illustrated by lantern slides and a large display of samples; and at its conclusion, Mr. Creasey was accorded a hearty vote of thanks, on the proposition of the President.

THE FITTING DEPARTMENT.

By W. W. Townsend, of Hereford.

[A Paper read before the Midland Association of Gas Managers, Mar. 2.]

In bringing before you these few notes, I have to acknowledge that the subject is not new, nor can I hope that my treatment of it will be novel. It will, however, do no harm to bring back your attention to a side of our business which may not be so congenial as the engrossing topic of carbonization, but which is quite as important; and a discussion on the many questions involved cannot fail to be illuminating.

In these days of strenuous competition, no gas undertaking can afford to neglect the study of the many and varied appliances now offered to the public, and, in the interest of both parties, the work of gas-fitting in all its branches must eventually come into the hands of the gas manufacturers, who alone can give the attention required to a business which is every day becoming more technical. Beginning in most cases with prepayment meter installations, and the hiring of various appliances, gas undertakings have been gradually forced into other work—such as maintenance of burners, and the fixing of high-pressure apparatus—and into more direct shopkeeping through the medium of show-rooms. It is not a very long step from this position to the establishment of a thoroughly equipped gas-fitting department which will undertake to supply and fix any apparatus for consumers, and, more than that, will take the responsibility of advising them, and of guaranteeing satisfactory results if such advice be followed. The importance of this subject was brought home to me when I went out to the tropics nine years ago. The Gas Company had to meet very fierce competition from the Electric Light and Tram Company; and they did so very successfully.

All the street-lamps, numbering 2000, were fitted with incandescent burners; and the Company were fined for every lamp giving less than 60-candle power. Quite 90 per cent. of the lights in houses and business premises were incandescents, and practically all of them were maintained by the Gas Company. All mantles and gas-fittings were sold and fixed by the Gas Company. In consequence, one could ride round the town at night and hardly ever see a broken mantle or a dirty burner; and this in a climate where dust and insects abound.

As illustrating the methods of this Company, I may say that the Chief Engineer canvassed for the lighting, &c., of a huge shop. They decided for electric light; but we got the order for gas-engines, dynamos, &c., and wired the whole building and supplied all fittings ourselves, and also fixed the machinery.

On my return to England, I could not help contrasting unfavourably the condition of matters in this country. Broken mantles, unsuitable fittings, air-hole globes without cones, &c., could be seen on every hand, though here and there an up-to-date installation (probably put in by the gas company) showed what could be done with gas if proper appliances were used.

Maintenance, whether "free" or not, only touches the fringe of this question, as it is impossible to obtain good results with bad burners and fittings; and if the consumer be referred to a third party for the fittings he requires, and obtains cheap ones, and unsuitable burners, his conversion to electric lighting is merely a matter of time. In some cases fittings are sold at a show-room, but the buyer has to get a private trader to fix them for him.

It is hard to see how it is possible to recommend the best fitting without seeing the place where it is to be fixed. The problems of illumination alone are very complex; and the services of the independent illuminating engineer not being available, the public have to depend on the advice given by the seller of the burner. Again, the merits and demerits of particular appliances can only be discovered after experience in fixing them and observing the results under varied conditions. The best laboratory fitting is not necessarily the best for the uninstructed public to handle.

All piping in the tropics is done in iron barrel, and in such a manner that the installation will stand 5 lbs. pressure. How many installations in this country will stand a pressure of 5 lbs., or even 5 inches, without showing leakage; and how many of the accidents which occur every year are due to the use of a material which is quite unsuitable for conveying coal gas!

Quite recently very serious escapes in composition pipes have come to my notice, which might have had disastrous results. Number one was caused by rats gnawing a large hole in a pipe fixed the previous day under a bedroom floor. Number two was caused by lightning; a large hole being burnt in the pipe and the gas ignited. Number three was caused by the fusing of an electric wire in close proximity to the compo. pipe, which was melted. Number four was caused by a careless piece of work years ago, a joint in the compo. pipe having been made by pushing one pipe into the other and plastering up the connection with white lead. Cases illustrating the penchant of the householder for driving nails into his gas-pipes, and stopping leaks with soap, are too familiar to need emphasizing.

Is not the time ripe for the Institution of Gas Engineers to consider this subject in all its branches, and lay down definite rules for the guidance of the whole industry?

It would be better in many cases if pipes, instead of being laid under floors, or buried in plaster, were laid on the face of the walls and ceilings, and hidden by capping and casing in the same manner as electric wires. The pipes would then be easily accessible, and new connections could be made, or leakage stopped, without damaging walls or floors.

Every installation in Hereford is tested for soundness by means of a dry pressure-gauge at a pressure of 8 inches of water; and this applies to every job done whether or not new piping has been fixed. It is somewhat disquieting to find that very few house pipes and fittings will stand this pressure. We owe something to our consumers in this matter, as they are usually blissfully ignorant of any defects, and are only too glad to feel that they are being looked after.

Among the popular impressions about gas is the idea that there is an inevitable slight odour of escapes in any house containing gas-fittings. Complaints fall under two divisions. (1) Defects in the supply, and (2) defects in the interior fittings. All gas undertakings accept responsibility for the first, but complaints under the second head far outnumber them. Following up a complaint of defective pressure recently, we found a large house supplied through a ¾-inch service and a 5-light meter, and there were four fires, a cooking-stove, and 15 lights. We did not stop short at enlarging the service and meter, but tested the pipes and inspected the fittings, with the following result: "Fires old-fashioned and extravagant, fumes not removed entirely. Cooker satisfactory. House pipes too small, badly laid, and not thoroughly sound. Fittings defective, ball joints leaky, burners not properly adjusted." It was useless to advise the consumer to refit the entire house, on account of the expense and trouble; but the difficulty was solved by fixing modern fires on hire, and running a separate supply for them direct from the meter. As 30 feet of free pipe is supplied for each fire, this enabled us to do the work free of charge; and a few new burners and some repairs to the old pipes and fittings made a fairly satisfactory job at a low cost to the consumer. My point in mentioning this case is that the consumer was not dissatisfied with his fires or fittings. His only complaint was that the light was better some nights than others, which he put down to variations in the quality of the gas. I am quite sure that if he had been told that the fault lay in his fittings, and referred to a private trader, he would have considered this a mere excuse, and would have done nothing. It soon becomes known that sound advice can be obtained from the Fitting Department, and requests for advice on all manner of subjects far outnumber complaints in my district.

Gas appliances are becoming more numerous in pattern and complicated in construction every year, and nobody but a specialist is competent to deal with them. Take shop lamps for instance, of which about 150 have been sold and fixed in Hereford in the past three years, most of them by the Gas Department. Lamps are sold as windproof which fluctuate considerably in a light breeze; and others advertised as rainproof are so defective that water drops from the mantles after a heavy shower. These defects can be cured, but only the gas department will take the necessary trouble.

A consumer told me recently that he did not see any advantage whatever in having his burners looked after by us, as his wife could put on a mantle as well as anyone. On inspection, I found "C" mantles on No. 2 Kern burners, which had not been taken apart for years.

In this connection, I may say that in my opinion it is a mistake to employ boys for maintenance work. The consumer often asks advice of the maintenance fitter when he sees that he knows his business; and, in fact, the best canvasser and advertiser a gas company can have is the man with a bag of tools and a thorough practical knowledge of gas-fitting. The ordinary canvasser who knows as much about the practical fixing of fires as he does about aeroplanes, is of little use, and often recommends things which are quite unsuitable for the purpose.

I have not much faith in the ordinary advertising leaflet either. People are so used to the habitual exaggeration of advertisers that they do not believe any *ex parte* statements. Nor does a great exhibition or a fine show-room seen occasionally suffice to efface the irritation caused by unsatisfactory fittings in the consumer's own house.

We heard recently of two consumers of this sort who had practically decided to instal electric light. A personal canvass, and an offer of some sample fittings on approval, and maintenance on easy terms, converted them entirely, and they are now highly pleased with their lighting, and they tell their friends.

As far as possible, all new people coming to the town are looked up, or written to, and much business may be got by this means. I recently approached a firm who were opening a shop in Hereford, but they declined my offer of ordinary lighting. A high-pressure scheme was then under consideration; and on the offer being made to them of high-pressure gas from a special main, they accepted almost at once, and the order was obtained both for lighting and heating.

The high-pressure main was laid through the principal streets to supply the covered market and any shopkeepers who wished to have it. The old high-pressure plant (upright burner system), which has been used for lighting the market for some years, has been remorselessly scrapped.

Though not strictly within the scope of this paper, one must say something about pressure, because it is certain that satisfactory results cannot be achieved unless every consumer is supplied with an ample volume of gas at a suitable pressure.

An excessive pressure is almost as great an evil as the other extreme. If a pressure of 30-10ths during lighting hours and 25-10ths during the daytime be maintained at every meter, general

satisfaction will be given. A lower pressure will not give the best results, a higher one will cause roaring of burners and a waste of gas, which will lead to increased accounts all round and consequent dissatisfaction.

If in order to maintain 3 inches pressure at the end of the district it is necessary to have 6 inches pressure at the works, the distribution system needs overhauling. Isolated cases of defective pressure may be cured by the use of motive power meters, which deserve to be better known in this country.

In my opinion, gas and air adjusters should be provided on every burner; but the gas-adjuster should be capable of very fine and gradual adjustment, and the air-adjuster should be so made that the air supply cannot be shut off entirely, and both should be capable of being fixed so that once set they cannot be altered accidentally. Many gas-adjusters are so sudden in their action as to be worse than useless.

The quality of fittings is another subject for consideration; and we owe it to our consumers to do something to protect them against the many cheap and worthless articles that are now on the market.

Prismatic reflectors are largely used for electric lighting, and are admitted to be the most scientific; yet they are not procurable for use with inverted burners.

Opinions differ as to the advisability of providing flue pipes and hoods for cooking-stoves; but the practical difficulties which are experienced may be overcome, and there can be no question that, unless the stove be fixed in a scullery or an outhouse, it is the proper thing to remove the fumes as completely as possible.

Unpacked cookers are not to be recommended; and it is difficult to justify their use for slot installations where economy is of more importance than with the better-class consumers.

If it be desired that the stove shall be constantly used, it is obviously better policy to provide the most efficient procurable, even if the cost be slightly greater.

Tests of cookers show surprising differences in consumption in stoves of the same size, and it is well worth while to test all that are sent out at the normal district pressure, and adjust them to the lowest consumption compatible with efficiency. Some rough tests which were made by heating 9 litres of water in a tin vessel which nearly covered the grid shelf, and noting the rise in temperature and gas consumption, gave the following results:—

Unpacked slot-cooker, iron dome . . .	11·7 per cent. efficiency
Ditto, with fire-brick dome	13·8 ,, ,, ,,
Packed cooker, with fire-brick dome . .	25·0 ,, ,, ,,

These results are merely comparative, and do not indicate the efficiency to be expected in cooking, when, of course, the whole of the oven space can be utilized.

In concluding, it may not be superfluous to say that when the fitting business is undertaken it should be done whole-heartedly. The department should be placed under the control of a practical fitter, who must have energy, tact, and address; and only by paying a good salary can such a man be secured. He will have enough to do in supervising indoor work and seeing consumers, without touching main and service laying, which is quite a different branch and requires altogether different qualities. The fitters should be well trained; and the stores should be central and well organized.

Some particulars with regard to my own district may be of interest, although I do not claim that there is anything wonderful about them.

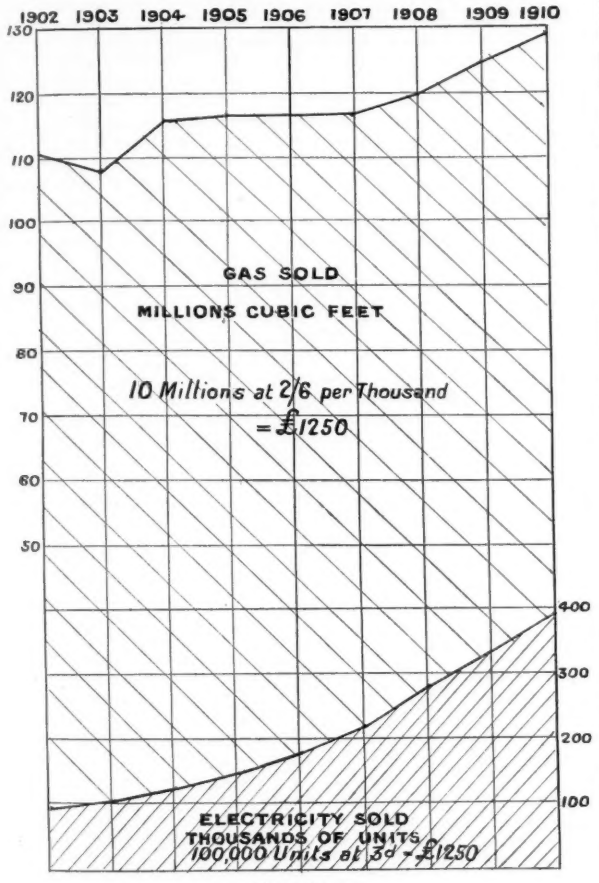


Chart No. 1.

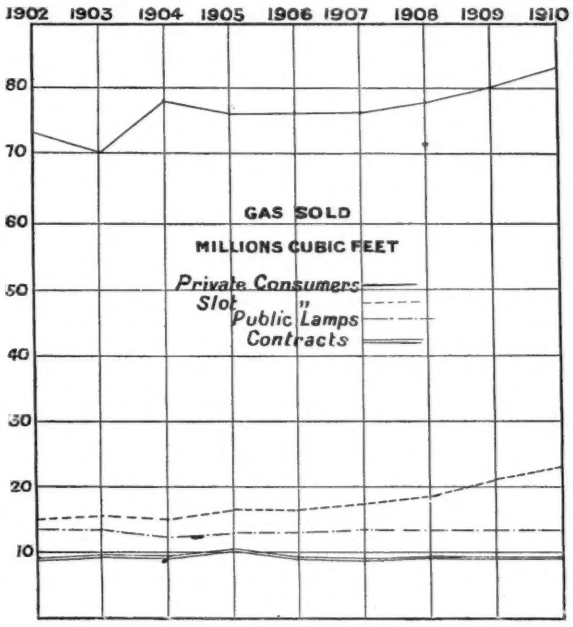


Chart No. 2.

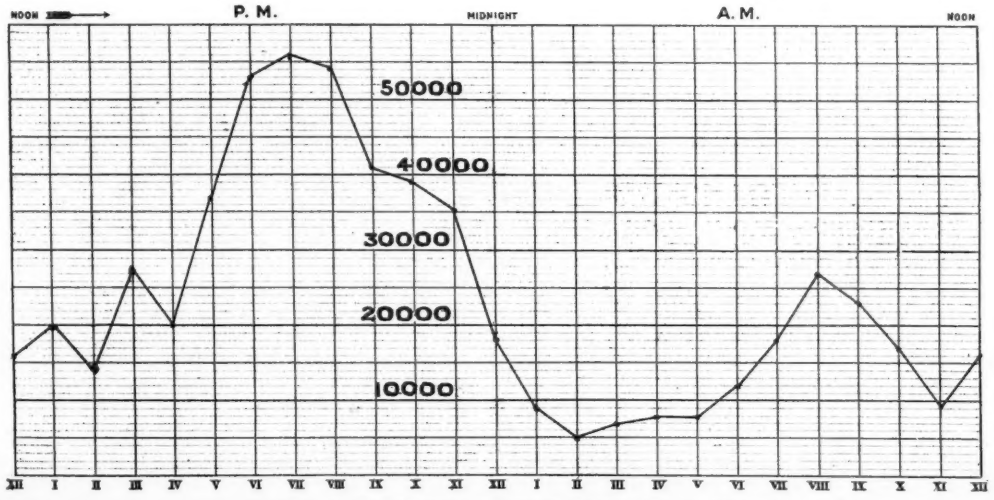


Chart No. 3.—Hourly Gas Consumption, Friday, Jan. 13, 1911.

Hereford has a population of about 22,000, which grows very slowly, and there are practically no industries. We have no proper show-room, yet a staff of twelve fitters is employed, with a foreman and storekeeper, and only a few slot installation jobs are done now. Four years ago, six men could do the work with ease; and this is the best proof that the services rendered are appreciated by the consumers.

Diagram No. 1 shows the increased consumption brought about during the past four years concurrently with a large increase in the business of the Electric Light Committee, whose mains have been extending to all parts of the town. Both gas and electricity are supplied by the Corporation, but are run quite separately.

Diagram No. 2 shows the details of consumption, from which you will see that the increase is chiefly due to the private consumers.

Diagram No. 3 is a chart of the hourly consumption on Jan. 13 last. The day consumption in the winter months is about 50 per cent., and in the summer about 52 per cent. The price of gas was reduced in 1905 from 2s. 9d. to 2s. 6d., and in September last from 2s. 6d. to 2s. 3d. The average price of electricity last year was 3d. per unit.

The price of gas is, of course, an important factor; but I would rather sell gas at 3s. with the aid of a fitting department, and with a free hand, than at 2s. without these very necessary helps in the fight against competition.

Discussion.

The PRESIDENT (Mr. J. H. Brown, of Nottingham) considered the paper bristled with points that were open to discussion, as all the questions the author had mentioned touched them very closely individually. There was one point that probably needed emphasizing, and that was the question of guidance by the Institution of Gas Engineers, with regard to the methods of dealing with consumers. Mr. Townsend was very fortunate in his Committee. In many towns, local feeling would not allow the municipalities to interfere with the business of the plumbers and the ironmongers, who had up to now had the installing in houses of the pipes and fittings. The author had shown how much better this could be done by gas undertakings. But if they had a lead given them by the Institution of Gas Engineers, they would be in a stronger position to approach their Committees, and practically compel them to take on this necessary work.

Mr. S. O. STEPHENSON (Tipton) congratulated the author upon his paper, remarking that the subject of fitting was a most important one. The old adage that profits were made in the retort-house, like many others, had become obsolete. They must now look for their profits to every section of the industry; and the fitting part was one that deserved and needed attention as much as any part of which he knew. He did not quite agree with Mr. Townsend's proposal to lay pipes into buildings, and carry them up to the ceilings in casings. He for one would not like the walls of his rooms spoilt in this way. One evil with which they had to contend was the fact that there was no qualification in regard to the gas-fitter. Any tinker, any boy, or individual could go into a house and do gas-fitting; there was nothing to stop him. The health and safety of the public demanded that some steps should be taken in the direction of ensuring qualified men for this work. A man should pass an examination and receive a certificate; and then if he was found doing improper work, the certificate should be endorsed, or suspended, or be taken away for a time. They had all had to contend with the speculative builder. When he wanted his houses fitted up, he generally desired that it should be done in the cheapest way; and he asked for prices. It was not very often he requested the gas undertaking to tender for the work. If he did, naturally an estimate was prepared for a proper job. When gas undertakings went into competition with the plumbers or the gas-fitters of their towns, they were completely bowled out, because the latter did not care a pin so long as they put in a cheap job, and the builder was satisfied. This sort of thing required to be done away with altogether. If houses were piped in this manner, they could not possibly supply gas satisfactorily. If the Institution could arrange to get this matter placed on a proper basis, so that no man should act as a gas-fitter unless he was qualified in some way, and had (say) a Board of Trade certificate, a big step would have been made. With inverted burners, gas-fires, &c., it was necessary they should follow up the consumer; and they must see that his burners were properly maintained. He had started free maintenance at Tipton. He gave free attention, and had a youth who went round regularly from house to house; and he simply charged for whatever material might be used—a mantle or a globe, as the case might be. He regulated and cleaned the burners and kept the fittings, burners, stoves, or anything else in order. He found this very satisfactory. The members would doubtless remember another step he had taken with regard to the fittings department—that was the introduction of inverted burners among the slot consumers. He had gone into this very largely, as he intimated to the Association two or three years ago. It was then feared that he was indulging in some sort of youthful recklessness; but the event had proved it was an unqualified success. It was predicted at the time that he would have the fittings stolen wholesale. He had not had any specific report of any fittings being stolen; but, on the contrary, the improved lighting had made the consumers more satisfied. It had increased the gas consumption among this class of people; it had certainly popularized the use of gas among the slot-meter consumers, who had now a good light. They not only consumed gas for lighting, but also wanted it for other purposes. If gas managers would only follow up the lines advanced by Mr. Townsend, study their fittings department, and look after the interests of their consumers—nurse them completely—he did not think they would have much to fear from electric or any other competition.

Mr. T. BERRIDGE (Leamington) said he hoped it would not go forth that gas managers wanted every fitter to be certificated, because if it did it might mean that they would have to pay a big price for it. He believed in work being well done; but not in having to pay excessively for it. He agreed almost entirely with all Mr. Townsend had said; but not with everything. He saw that when the author returned to England from abroad, he was very unfavourably impressed with the condition in which incandescent burners were kept at home compared with what he saw abroad. He evidently did not visit Leamington. [Laughter.] He (Mr. Berridge) believed in free maintenance. At Leamington, they adopted a similar system to Mr. Stephenson. They had a staff of men who went round the town, and attended to the people's fittings. The consumers were not charged anything for this, but only for the mantles or whatever else was used—in fact, if the Company were in competition with the electric light, they were willing even to put the fittings in free. He did not believe in the Institution of Gas Engineers, or anyone else, fixing rules or anything else for their guidance in this matter. He believed absolutely in free trade. He cordially agreed with pressing forward outside shop lighting; and he believed in doing it on the hire-purchase system. If they went to a tradesman and told him a lamp would cost him 3s. a quarter, they were more likely to get him than if they asked him to pay £3 for a lamp. In laying down a system of high-pressure lighting for shops, he should prefer to charge for the supply of (say) a 1000-candle power lamp, and cleaning and maintaining, one-third of the stipulated sum in each winter quarter and one-sixth in each summer quarter, or something of that kind. With reference to the employment of youths for maintenance work, they had some young fellows whom they found very satisfactory; and these they trained to be gas-fitters. Personally, he believed in a good show-room; and he thought a gas company ought to have the smartest shop in a town. He also agreed in calling upon all new people who took up their residence in the place. In his case, if they removed a meter from a house that had become tenantless, they left a card, saying the Company's representative would call to give advice, and a post-card was sometimes also left for the purpose of making an appointment. With reference to pressures, Mr. Townsend spoke of having 3 inches pressure at the extreme ends of the district, and talked about 6 inches on the works. It seemed to him (Mr. Berridge) that what they would have to come to would be a governor on every house service. If a man adjusted the burners in a consumer's house at one time of the day, in the evening, if there was no governor on the service, the adjustment might be altogether wrong for the pressure. Much better results would be obtained by individual governing. There was no question about it, they had to work to higher pressures now, and would probably have to work to still higher ones in the future. His experience was that this did not make any difference to the leakage. His leakage now was only 2·4 per cent., and he was working to much higher pressures than ten years ago. As a matter of fact, the percentage of leakage had gone down. The population of Hereford was somewhat similar to that of Leamington; and, in his town, they found they had to adopt every possible course to cultivate the business—by, for instance, letting out gas-fires and other things cheaply. Their competitors were always going round trying to steal away their customers; and the only thing to do was to go one better, and get some of them back again.

The PRESIDENT: Mr. Stevenson, of Long Eaton, has to meet fierce competition; and we should like to hear him.

Mr. G. E. STEVENSON (Long Eaton) said he might mention that, having had a fitting department going for twelve years, he could thoroughly endorse everything that Mr. Townsend had said with regard to the benefit accruing from it to the gas undertaking. Conditions varied considerably from those of a company where the gas-works belonged to a local authority. In such cases it was often impossible to adopt the same means for pushing the sale of gas as in a private company like his own. They did all the work mentioned by Mr. Townsend—in fact, they did a little bit more. They canvassed rigidly all new houses; and he kept a careful record as to whether they were wired for electricity or piped for gas. He had gone so far as to subsidize the builders to put in connections for gas-fires. It was rather a forward policy to pursue; but it had paid him very well indeed. In some houses, it was difficult to get householders to have pipes put in, where long lengths would be required, for the purpose of gas-fires. There was one point that was worth consideration. They had a large number of slot and ordinary cookers fixed; and these cost money for maintenance. Some twelve years ago, he instituted the system of sending a lady demonstrator round regularly; and he found that the cost of cleaning cookers and general repairs was much reduced by her visits. Thereafter, certain of the neighbouring companies combined with his, and kept the lady demonstrator going the year through, with considerable advantage to themselves. They received from her a district report on each cooker; and at the same time, she took the opportunity to instruct the consumers. With regard to the present condition of lighting, there seemed to be something lacking as to the standardization of burners and mantles. Those who ran burner and lamp maintenance schemes knew the infinity of

differences there were in sizes. They found five or six different sizes with "universal" fittings. [Laughter.] There was a point with regard to shop lighting and hire-purchase of lamps—that it was advisable to put in only the highest grade of lamps. Some gas managers had had very unfortunate experience with cheap stuff; and it did not pay. They also found with regard to power, that it paid to equip any manufacturer with power and other incidental things; and not only that, but he presented reports on the proper working of the engines and general plant. In his case, the work of selling gas had been rendered a much harder job than formerly. With electricity at ¾d. per unit for power and 2d. for lighting, the task was not made lighter; and the new metallic filament lamps were something that had to be reckoned with. They had done for electric lighting what the mantle had done for gas, and unless gas undertakings saw that the consumer obtained the best efficiency, he thought they would suffer very considerably. He hoped the outside department would have more attention in future papers from other members.

Mr. W. C. Jones (Brierley Hill) remarked that it was undoubtedly a great assistance to have a gas-fitting department. In his own case, he had had this brought home to him very forcibly. A few years ago, the ironmongers in his town grumbled considerably at their trade in gas-fittings, mantles, &c., having been taken away from them by the Gas Company being able to do the work at less cost than they were doing it at. There was something in what they said. The reason this was done was that they had been selling the cheapest and commonest mantles they could buy, and the ones on which they could get the greatest profit. But some years ago, when coming to an agreement with the ironmongers, he decided that he would not sell mantles below their prices, providing they started to sell a better class of mantles. For several years they had tried to work on these lines, until during the last six months it was brought to his notice that, to a large technical institute or school, which was lighted by self-intensifying lamps, one of the ironmongers was charging 11s. a dozen for mantles listed at 9s. This was making the total bill for lighting heavier than it ought really to have been; and this after he (Mr. Jones) had been at the trouble to demonstrate that gas was cheaper than the electric light. It seemed to him that, if the people had to pay in this way for mantles, it would not be long before the installation named was altered back to electricity. He therefore got his Directors to go to the other extreme, and to adopt free maintenance and sell good mantles at reasonable prices—inverted ones at 3d., and high-pressure ones at a higher price. They had now got back again practically the whole of the mantle business; and there was a great improvement in the lighting generally. Only a fortnight previously, the Company had a letter from the Council thanking them for the improvement in the lighting of the streets. Mr. Townsend appeared to be opposed to the use of compo. piping. He (Mr. Jones) did not agree with him altogether, as in some cases it was more useful than, and therefore preferable to, iron piping. Regarding pressures, the author spoke of having 6 inches pressure in order to get 3 inches in certain places. In his own case, if they had 6 inches at the works, they often got down to 30-10ths and 25-10ths. In his opinion, service-governors regulated down to the minimum pressure given at the consumers' inlet-pipe gave more satisfaction than where there were fluctuations of 5-10ths or 10-10ths. As to the question of packed or unpacked cookers, he had made an experiment; and he found that with an unpacked cooker it cost to do certain work 5d. (gas at 20 cubic feet for 1d.), while with a packed cooker the same work was done for 3d. Needless to say, after this, he got his Directors to adopt packed cookers for hire purposes; and nothing but such cookers were now adopted in Brierley Hill. In his case, they allowed the slot consumers to have inverted burners if they liked; but the majority preferred the upright form. He had found that it was absolutely necessary, if they were to meet electric light competition, to go to work with a good will and on liberal lines.

Mr. H. E. Copp (West Bromwich) said that, as probably most of the members were aware, he had been much interested in the fitting department. Some four or five years ago, he read a paper in which he expressed himself very strongly in regard to the rubbish that was being foisted on the consumers in the way of incandescent lighting goods. The evil, he thought, was worse to-day than it was then. It seemed to him the great difficulty of the fitting department was that the average Englishman considered himself an expert in lighting, and one could not teach him anything on the subject of lighting or ventilation. Therein was one difficulty in getting into touch with the householder, and in popularizing the department. One thing he should like to ask Mr. Townsend was this, as to the method he adopted for charging for high-pressure gas. It seemed to him (Mr. Copp) that this was a burning question. There were meters which would register high-pressure gas automatically and correctly. But unfortunately they were expensive; and if they had an inferential meter (an ordinary one could not be employed), they registered the gas at a false volume. This question of the measurement of high-pressure gas was one that would no doubt crop up with all of them sooner or later. Talking of the efficiency of lights, their salvation would, it seemed to him, lie in future in high-pressure gas. Then came in another question if they were going to use high-pressure burners. There was a vast difference in the efficiencies of these burners. Some were made for 2 lbs. per square inch pressure, and gave no more efficiency than the ordinary inverted burner. He had in tests observed them down as low as 30 candles per cubic foot, while he had noticed others as high as 65 candles per cubic foot. The question was whether any of them knew much about high-pressure burners and lamps, because, as a matter of fact, there was little information available at present. Another point that suggested itself in connection with the paper was whether there had been any development in the direction of burning-off mantles by gas undertakings. He had not heard of any of late. In West Bromwich, they had been doing it for six years with satisfactory results. They had a better mantle and a stronger mantle, and, furthermore, it possessed the advantage that, once set in position, there was no fear of anything happening to it with fair usage. He believed this burning-off was done largely in London; but he had not heard of it being done much in the Provinces. He regarded this subject of the fitting department as being of vast importance to the industry at the present time.

The President agreed that the question of the fitting department was a very important one; and the necessity for it showed what a great development there had been in the distribution and use of gas. Only the previous day, he heard that a new metallic filament lamp was being put on the market which was showing 50 per cent. greater efficiency than any existing type. Therefore, the gas industry was, it seemed, again being threatened with extinction. [Laughter.]

Mr. Townsend, in reply to the discussion, expressed his gratification at the kind reception of his paper, which was a maiden effort in this direction. He agreed with the President that it was rather difficult for a gas engineer employed by a municipality to start a fitting department. In his own case, he was fortunate, because the department was actually in existence on a smaller scale when the Corporation purchased the undertaking from the Company. He did not think this was altogether a question of municipal *versus* private trading, because he found that, with all the department was doing, the plumbers in the town did not employ less men, while the fitting department employed more. It was the electric light that employed less. The electricity supply in his case was owned by the Corporation. He had had a little experience of the trouble to which the President had referred in connection with the ironmongers; but it was overcome by means of a little tact. The principal ironmonger who was loudest in opposing the department three or four years ago when it was proposed to take up fresh work, had just given him (Mr. Townsend) an order for six or seven high-pressure lamps for a shop; and he admitted that the fitting department must know more about high-pressure lamps than he did. However, he (Mr. Townsend) let him buy the lamps, and do the necessary pipework at cost price. If plumbers recognized that gas undertakings had to fight the electric light, they would also see that it was an unreasonable thing to expect them to sit still, and see their business filched from them while, by employing suitable men, they could retain it. With regard to Mr. Stephenson's remarks as to surface piping in wood casing, he (Mr. Townsend) did not recommend it in every case. He had an instance of a public house with cement floors; and the landlord asked one or two plumbers if they could not do some gas-fitting in the place without disturbing the floors and walls. The plumbers thought not; but from his (Mr. Townsend's) Colonial experience, he showed how it could be done without touching the walls at all. It enabled them to get an order for gas lighting where they would have lost it. With regard to the certification of fitters, there had been a good deal of discussion about their education and so on. To his mind, this was not going to solve the problem. It was not, in his opinion, so much the efficiency of the training of the men; it was the masters who were wanting. If he (Mr. Townsend) were to give his employees over to a plumber, the work would not be so well done, because the plumber had only to make a profit out of the work, while the gas undertaking had to consider the future sale of gas. Of course, there would be some improvement if they had a better class of men. With regard to the sizes of pipes, the Manchester Institution had gone very thoroughly into this matter; and they had drawn up a specification of standard sizes of pipes. But it was very difficult to enforce them. In his own case, he took the liberty of making extracts from the specification, and issued a circular to plumbers and builders containing recommendations as to the sizes of pipes to be installed in all buildings for different purposes. He found, in cases where the circular was preserved, that use was made of the information given in it. He might say that he did not do carcassing work. This was much better left to the plumbers. All the work of the fitting department was after the pipes had been put in, except, of course, in slot-meter installation work. Regarding Mr. Berridge's remarks, he might say that when he returned home from abroad he landed at a port on the South Coast; and his experience related more to the South of England than to any other part. This was several years ago; and there was no doubt the lighting was rather better now than then. However, there was still room for improvement. With regard to high-pressure lighting, Mr. Berridge stated that he went in for a tariff charge of so much per annum. He (Mr. Townsend) preferred to put in a meter, as he thought it better to allow a consumer to use the lamps as long as he liked, and pay for all the gas he consumed. He had gone in for the meter to which Mr. Copp had referred, which automatically corrected the volume registered according to the pressure; so that they got an absolute registration on the meter corrected to normal volume. They charged a fixed price for maintenance of the burners according to candle power, and it included a sum to pay for the high-pressure main. Mr. Berridge did not agree with him as to employing fitters for

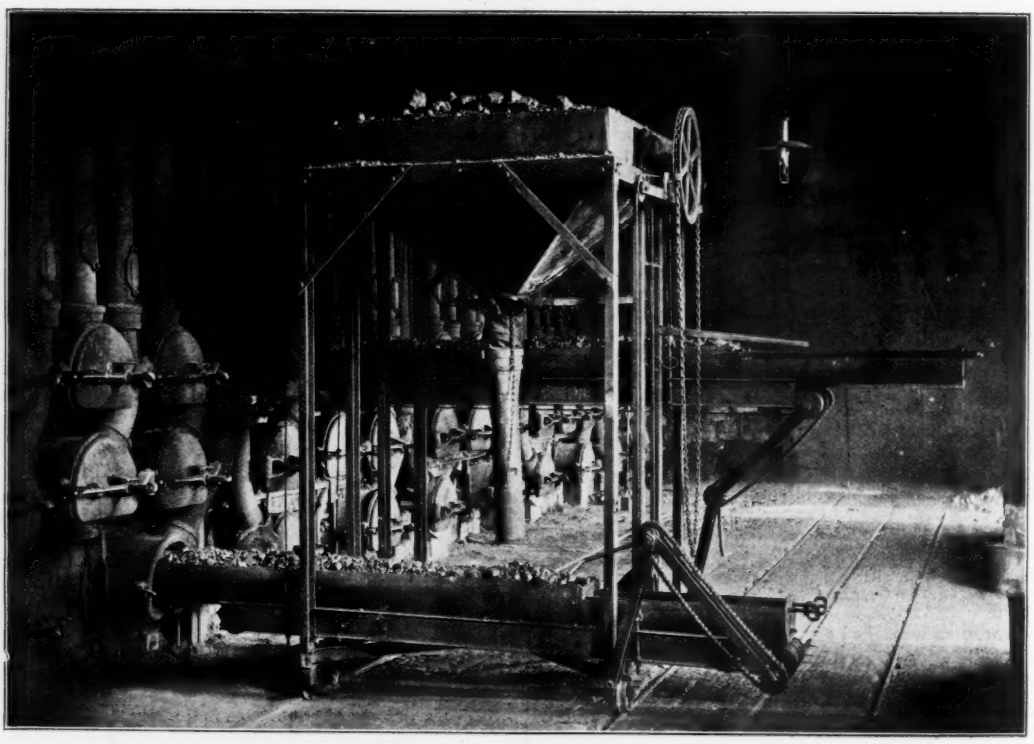
maintenance work. In his own case, he only employed boys under the fitters, and thus they learned their business in a practical way. If a boy was put on to burner maintenance, he was no good for anything else; but if a qualified man went round, he could deal with an order for a gas-fire, a boiler, or anything else. He agreed with Mr. Stevenson, of Long Eaton, about the lady demonstrator. He (Mr. Townsend) tried the idea, on a small scale, last summer. He found that in many cases the ladies knew all about the cooking of meat in gas-ranges, but did not understand how to do pastry with gas. But the instruction of the lady demonstrator had resulted in a larger use of the cooker for this purpose than before. In reply to Mr. Jones, he did not agree with his remarks about compo. pipe. He (Mr. Townsend) condemned such pipes because they were so easily punctured; and he did not think coal gas should be distributed in pipes that could be made to leak so easily. His remarks as to pressure, of course, applied to districts in which there were no service governors. With regard to the burning-off of mantles, he thought when they had to be carried long distances, it was a great advantage to have them non-collodionized, and to burn them off on the premises, as was done by most Continental and Colonial gas undertakings. But he did not think there was any great advantage in small undertakings in the Provinces doing it. The London Gas Companies were turning out a sufficient number of mantles to make it worth while their doing it.

On the motion of Alderman Cooper, seconded by Mr. W. S. Morland (Gloucester), a hearty vote of thanks was passed to Mr. Townsend for his paper.

Mr. Townsend acknowledged the kindly expressions used by the proposer and seconder, and the cordial manner in which they were endorsed.

BIRD'S "SIMPLEX" RETORT-CHARGING MACHINE.

In last week's issue of the "Journal," in connection with the visit of the members of the Isle of Wight Gas Association to Ryde, an illustration was given (p. 604) of a new type of manual charging machine, specially adapted for use in small gas-works, which was seen in operation. The apparatus—which is the invention of Mr. Bird—is about to be put on the market by the "Simplex" Retort-Charging Machine Company. The photograph then reproduced was of a single machine; and we are now able to supplement this with an illustration of the double form—the one which was more particularly described last week.



Recent Wills.—Mr. John William Bray (Chairman of Messrs. George Bray and Co., Limited), of The Hall, Scalby, Scarborough, whose death on the 15th of January was noticed in the "Journal" at the time, left estate valued at £61,830 gross, with net personalty amounting to £59,341. Among the provisions of his will, deceased empowered his Trustees to carry on, at the expense and for the benefit of his estate, his research laboratories at West Park Terrace, Scarborough. Mr. William Butler Whitaker, for many years Engineer of the Argentine Gas Company at Buenos Aires, who, as already recorded, died on the 3rd ult., aged 70, left estate in the United Kingdom of the gross value of £36,416, with net personalty amounting to £36,301.

Accidents in Factories.—The report of the Departmental Committee on accidents in places under the Factory and Workshops Acts was issued last Wednesday. It shows that the total number of reported accidents rose from 79,020 in 1900 to 100,609 in 1905; while between 1905 and 1907 there was a further increase to 124,325. The increase in 1905 was specially noticeable in certain trades. In the textile trade, the non-fatal accidents increased in these years by 44·2 per cent., in metal founding by 46·07 per cent., and in engineering, &c., by 35 per cent. The increase generally in the non-textile factories was 35·83 per cent. There has been since 1907 a tendency for accidents to decrease, which is thought to be due to the Workmen's Compensation Act, as well as to the better guarding of machinery and to the watchfulness of the Factory Inspectors. The Committee consider that the accident risk is higher than it should be, and that specific provisions should be added to the Factory Act as a preventive.

Southern District Association.—We learn from the Hon. Secretary (Mr. W. E. Price, of Hampton Wick) that the annual meeting of the Association will be held on Thursday at the Hotel Cecil. The business will comprise the presentation of the report of the committee, the reading of the address of the President (Mr. H. C. Head, of Winchester), and the resumption of the discussion of Mr. Broadberry's paper on "High-Pressure Lighting," read at the November meeting last year. At the close of the business, the members will assemble at the annual dinner.

The Discovery of Natural Gas near Hamburg.—The American Consul-General at Hamburg gives additional details with reference to the natural gas which has been discovered at Bergedorf, in the vicinity of Hamburg. The quantity of gas now escaping from this well is about 560,000 cubic metres (19¾ million cubic feet) per 24 hours; and it has varied little since the discovery of the deposit early in November last. Nevertheless, competent engineers of the city of Hamburg are of the opinion that the deposit is limited, and that it would be unsafe to invest any money for further exploration or for the utilization of the existing well. The gas was reached at a depth of rather more than 800 feet, on property which had been leased to the State of Hamburg, and which was being drilled to add to the city water supply. The gas escaped with a tremendous noise; and when it came into contact with oxygen, it caught fire—the blaze being about 8 feet high from the mouth of the boring-tube, and 30 feet high on each side of it. A pipe has been placed over the orifice of the well, and the gas can now be put out and re-ignited at any time without difficulty.

REGISTER OF PATENTS.

Treatment of Tar.

EATON, E., of Dowgate Hill, E.C.

No. 3279; Feb. 10, 1910.

In carrying out this invention, the patentee proposes to employ two stills or tar heaters, the flues of which are so arranged in relation to each other that the hot gases or air of one still are employed to heat both the stills—the furnaces being preferably used alternately and the flues so arranged that the hot gases can, by an arrangement of dampers, be directed from contact with one still to contact with the other before escaping to the chimney; "the precise arrangement of the flues being immaterial, providing the result above mentioned is obtained."

It is, he points out, usual with stills to employ a storage tank from which the raw tar is supplied by gravity or otherwise; and as a further development of the primary feature of this invention, he raises the temperature of the tar in the tank by conducting the heated gases or vapours of distillation from each still through a coil arranged in the tank and connected outside the tank to a condenser. As a further improvement, he corrugates either or both the bottoms of the stills and the bottom of the mixer so as to present a larger heating area to the furnace; and he also introduces blasts of hot air from the furnace into the stills themselves and into the closed mixer (which has an agitator) into which the tar is drawn after the treatment in the still, and in which it is mixed with sulphuric acid in the usual manner.

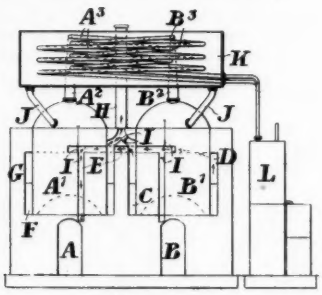
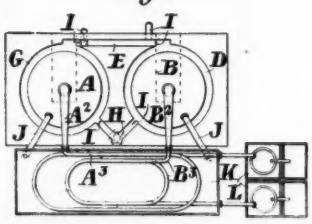


Fig. 1.



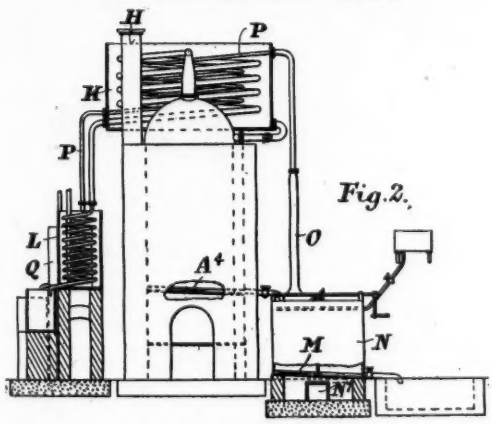


Fig. 2.

Eaton's Tar-Stills.

Fig. 1 shows, "largely diagrammatically," a part of a still constructed according to the invention, in which two furnaces A B are provided to heat the stills A^1 and B^1. Assuming the furnace B to be in action, the hot gases will travel round the still B^1 by the annular flues C D, from the latter of which they pass, by the cross flues E, to the annular flues F G around the still A^1 before they escape through the shaft H—dampers I being provided to open the flues correctly. The stills are provided with supply pipes J; and the outlets or swan necks A^2 B^2 are carried up to the coils A^3 B^3 in the supply tank K before being led to the condensers L.

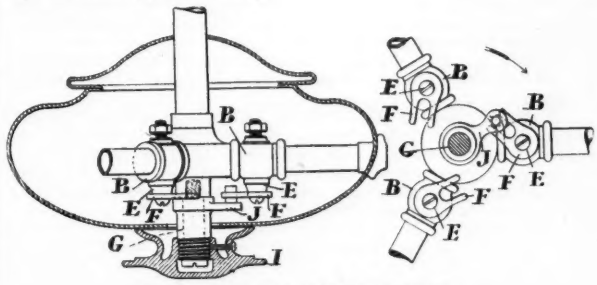
Fig. 2 shows a still having much the same features, and, in addition, a corrugated bottom A^4 to the still and a corrugated bottom M to the mixing-chamber N, with furnace N^1. The flue O from this mixing-chamber is connected to a coil P in the tank K before being led by the pipe P to the condenser Q, in which the sulphur is recovered after the acid has been admitted, or to another condenser (not shown) in which the vaporized light oil is collected (of which there is a quantity when the furnace N^1 is in operation) before the acid itself is admitted to the mixer.

Gas-Fittings.

BEST, R. H., and HAMLYN, S. W., of Handsworth.

No. 11,676; May 11, 1910.

This invention provides for the operation or control of two or more taps on the one pendant fitting.



Best and Hamlyn's Gas-Tap Operator.

The invention is shown applied to a pendant having three arms each controlled by its own tap B. The taps are around a central body forming the connection between the depending central gas stem and the branches. The conical plug of each tap has an extension E on which is a tappet piece F, of fork-like form. Upon the lower side of the central body there is arranged a spindle G, adapted to support a sleeve fitted with a finger or grip piece I. The sleeve carries a crank J, at the outer end of which is a pin adapted (on the rotation of the crank by the finger piece) to engage, in turn, the tappet piece F of each tap. Thus, according to the extent and direction of the circular movement of the crank, one or more of the taps may be turned on or off as required.

By making the tappet pieces of forked form and causing the crank-pin to engage by entering between the forks, there is obtained "a simple stop-device for limiting the circular movement of the crank to one rotation." There is thus no need to have the usual nighting or stop-device on each tap. This is clearly seen from the plan, where the taps are all in the closed position. To open the taps, the crank J must be turned in the direction of the arrow. If turned in the opposite direction, the pin encounters the boss of the adjacent tappet piece, and is arrested without moving the pieces.

Mouthpiece for Incandescent Gas-Burners.

SCHUCHARDT, G., of Berlin-Rixdorf, and R. FRISTER AKTIEN-GESELLSCHAFT, of Oberschöneweide-Berlin.

No. 15,435; June 27, 1910.

It has been previously proposed to obtain an even illumination of the mantle of incandescent gas-burners, the patentees state, by the provision of lateral apertures or with outwardly inclined holes in the burner-head. Further, the attempt has been made, with the aid of a pipe perforated on one side, to cause the flame to be directed not in the axial direction of the burner-tube, but at right angles to it, and also to produce a form of flame suitable for horizontal incandescent members with the aid of a burner-head cut off obliquely in front and covered by a perforated plate.

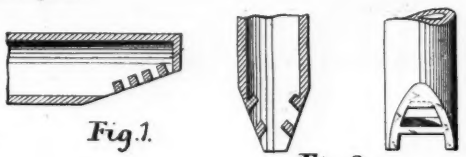


Fig. 1. Fig. 2.

Schuchardt's Incandescent Burner Mouthpieces.

Burner mouthpieces according to the present invention have such a construction (as shown) that the mixture of gases, on leaving the burner-tube, can have any direction imparted to it; this being effected by the mixture being conducted against ribs or bars having more or less great inclinations, and arranged in the mouth of the burner after the manner of the bars of a step-grate.

In the case of inverted burners (fig. 2), the burner mouthpiece is provided on two or more sides with outlet openings and deflecting ribs or bars arranged like the bars of a grate; so that, in addition to the central outlet opening of the mouthpiece, lateral outlet openings are provided from which the mixture of gas and air flows in an oblique direction against the mantle.

The mixture of air and gas is said to be "uniformly throttled at the ribs arranged in the mouth of the burner at right angles or inclined to the direction of the current of gas, and is so deflected in the desired direction that the flame produced in this manner is able to heat the incandescent mantle uniformly."

Fig. 1 illustrates a burner mouthpiece for a horizontal burner—in longitudinal section, an under-plan, and an end elevation. Fig. 2 illustrates a burner mouthpiece for an inverted burner in longitudinal section, side elevation, and under-plan.

Electrically Lighting Gas-Burners.

DELAGE, M., and WOOG, P., of Paris.

No. 11,362; May 7, 1910. No. 13,797; June 7, 1910. Date claimed under International Convention, May 7, 1909.

The first invention has for its object to electrically light gas-burners by the aid of oscillatory high frequency currents.

Two circuits are here employed, one of which contains a source of

electricity—a self-induction coil, magnetic trembler, and condenser—and the other the magnetic trembler, a condenser, the primary of a lighting coil, and a switch. There may be several circuits, each containing the primary of a lighting coil; and each circuit is provided with its own switch. The electro magnetic properties of the current may also be employed for the purpose of electrically operating the gas-taps. Thus while all the burners may be lighted as a whole, the current may be employed for turning on, or wholly or partially turning off, any individual gas-tap at will.

The apparatus for electrically lighting gas shown in patent No. 6154 of 1910 [*ante*, p. 317] may, with advantage, the patentees say, be used in combination.

The arrangement according to the second invention differs from that already described, in that the main condenser is placed in shunt directly between the terminals of the self-induction coil. The primary circuit, therefore, comprises a source of electricity, a self-induction coil between whose terminals the condenser is shunted, the primary of a lighting coil, and a trembler provided with its condenser.

Coin-Freed Meters for Gas-Fires.

YATES, H. J., of Aston, near Birmingham.

No. 3377; Feb. 11, 1910.

This invention has for its object to provide (for use more particularly in hotels) prepayment time-valves or control-devices, by which the quantity of gas passed for a coin of given value is determined by the duration of flow.

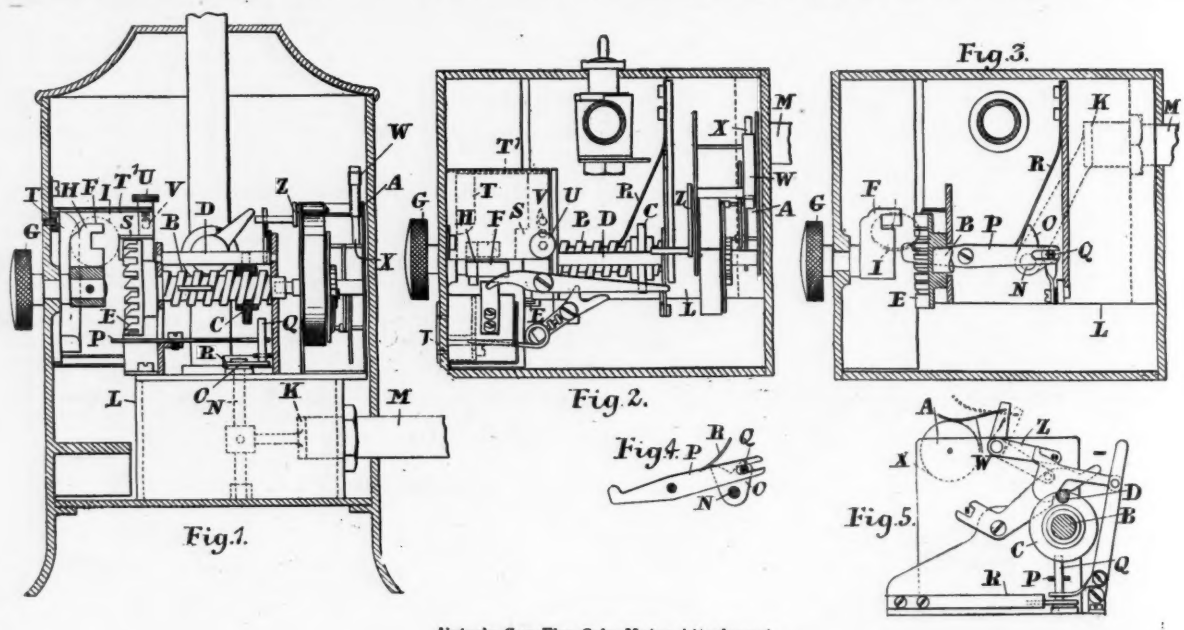
The invention comprises the employment, in conjunction with coin controlled clock mechanism, of means for "imparting rapid closing movements to the valve in order to prevent the occurrence of such an insufficient or throttled flow of gas through the valve as would result to a detrimental extent in combustion within the burner." The invention also comprises means for protecting the device against improper usage.

Fig. 1 is a sectional side elevation of the coin-freed gas supply-control device. Fig. 2 is a sectional plan of the mechanism taken above the main operating screw. Fig. 3 is a similar view taken below the screw. Fig. 4 illustrates the valve-operating lever in a different position from that shown in fig. 3. Fig. 5 is a sectional end elevation of a portion of the device showing the mechanism for actuating the valve and clock.

The lever clock mechanism A imparts rotation in one direction to a coarse pitched screw B carrying a nut C which, while free to slide along the screw, is prevented from turning by its engagement with a guide D. At the end opposite to the clock, the screw is provided with a radially notched portion E of a coin-carrier; the independent complementary portion F being mounted coaxially and arranged for operation by an external knob or handle G. The latter portion of the coin-carrier is formed with a single notch or pocket H, into which the coin can be inserted through a slot J in the case.

The gas-valve K (preferably of the pivoted type) is placed within a chest L adjacent the outlet M. On the outer end of the valve pivot or spindle N, which projects through the valve chest, is secured a bell-crank lever O, one end of which is engaged by a forked or slotted lever P through a pin Q, while against the other end abuts a spring. The extremity of the lever opposite to the bell-crank or valve-operating lever is placed beneath the coin-carrier in such a position that it can be actuated by the coin.

After the insertion of a coin through the slot in the case, it is first traversed by the rotation of the knob G over an adjustable guard S the position of which can be varied to suit the price of gas. The guard consists of a segmental strip mounted adjacent to the part E of the coin-carrier, and arranged to prevent the coin from engaging the notches. On reaching the end of the guard, or a gap in it, the coin falls into a notch in the portion E of the carrier secured to the screw, and thereby connects the two parts of the carrier, so that with the



Yates's Gas-Fire Coin-Meter Attachment.

further motion of the knob the screw is rotated for the winding-up of the clock spring and the nut C is retracted along the screw. To ensure the coin engaging the part E, a segmental abutment piece T is arranged at one side of the path of the coin, and is formed with an inclined portion at the leading end, which, as the coin passes over it, causes the coin to move laterally into engagement with the carrier portion E. When the carrier approaches the end of its movement, the coin abuts against the projecting end of the lever P, and during the completion of the carrier movement rocks the lever sufficiently to open the valve K through the lever O; and the spring R abutting against one end of the lever is also deflected or compressed. As only a small portion of the carrier movement is utilized for actuating the valve, it follows that the latter is, with ordinary usage, opened quickly.

The coin is prevented from falling out of the carrier until it reaches the end of its travel by a segmental guard upon which the guard-piece S is adjustably secured by the screw U. On detaching the screw, the guard can be moved so that the coin engages the part E either earlier or later in the movement of the part F. The apertures V in the guard are provided for the reception of the screw U, and correspond to various prices of gas. Backward rotation of the carrier, which might be utilized for fraudulent interference with the proper action of the mechanism, is prevented by the ordinary ratchet on the clock. After the coin has dropped out of the carrier, the portion of the carrier which is connected to the knob can be returned freely to its initial position.

While the gas-valve is closed, the clock is held stationary by the pressure of a pivoted spring blade W against the balance-wheel X; the blade being maintained in its operative position by a lever Z, actuated by a lift-piece pivoted on a lever connected by a link to the pin Q of the bell-crank lever O. It will be observed that this lift-piece rests on the nut-guide D. When the lever is inclined towards the right-hand side (as in fig. 5), the lift-piece is raised by its abutment on the bar D to its uppermost position; and by the action of the lift-piece on the pin of the lever Z, the latter is raised into the position for applying the blade W to the rim of the balance-wheel X and stopping the clock. On moving the lever over towards the left-hand side (fig. 5), the lift-piece falls under its own weight in the direction of the nut-guide D, and permits the lever Z to fall also under the impulse of the spring blade W, whereupon the blade is withdrawn from contact with the balance-wheel X, and the clock is permitted to automatically re-start under the action of its own spring.

By the operation of the clock, the screw B is slowly rotated in the opposite sense to that produced by the coin; and the nut C is gradually returned to its original position. During the latter part of its return movement, the nut engages the pin Q of the bell-crank lever, and moves it into such a position as to enable the lever to be operated by the action of the spring alone. It will be seen from fig. 4 that a slight movement of the lever O is sufficient to enable the spring R to operate. As soon as the spring can operate, it immediately returns the bell-crank lever to its original position, and thereby closes the valve independently of the clock-actuating mechanism. With such movement the mechanism connected with the spring blade which acts on the balance-wheel is also operated and the clock stopped.

By employing a screw of sufficient length, a number of coins can be inserted successively into the apparatus and the duration of supply increased. To prevent the introduction in immediate succession of more coins than the device is designed to take, a hinged stop is arranged behind the part F of the coin-carrier, and in conjunction with this stop is arranged a lever adapted to be actuated by the nut C on the screw B. When the nut reaches the limit of its movement, it advances the stop by its action on the lever into such a position that the stop prevents the part F of the coin-carrier from returning to its initial position opposite the coin-slot J. The slot is then closed by a shutter (carried on a spring blade), which closes the coin-slot after each operation of the carrier, and is returned against its spring action by the coin-carrier each time the latter returns to its original position, except

when prevented as already described. The lever for actuating the stop is formed with a bifurcated end as shown in fig. 2, in order that the nut C may impart to it a positive movement in either direction. When moving away from the clock, the nut rocks the lever in one direction; while when moving towards the clock, it rocks it in the opposite direction. Assuming six coins to be the maximum number insertible at any one setting of the apparatus, and assuming also that during the return movement of the nut another coin is inserted before the nut has quite completed one-sixth of its movement, the resiliency of the lever enables the part engaged by the nut to be moved slightly past the ordinary limit without straining the parts engaging the stop B.

As a precaution against improper use of the device by a coin inserted after the gas-valve has been opened, the valve can be automatically closed temporarily by the coin during the first part of its movement with the carrier. For this purpose, the levers connected with the clock stopping and starting device are utilized. In conjunction with such levers is arranged a lever with one end adjacent to the coin-slot (see fig. 2). This end abuts against a spring blade which projects across the path of the coin. Immediately the inserted coin is moved forward by the carrier, it presses against the spring blade, and, by deflecting it, causes the lever to stop the clock and close the gas-valve. On reaching the end of its travel, the coin re-opens the valve as described.

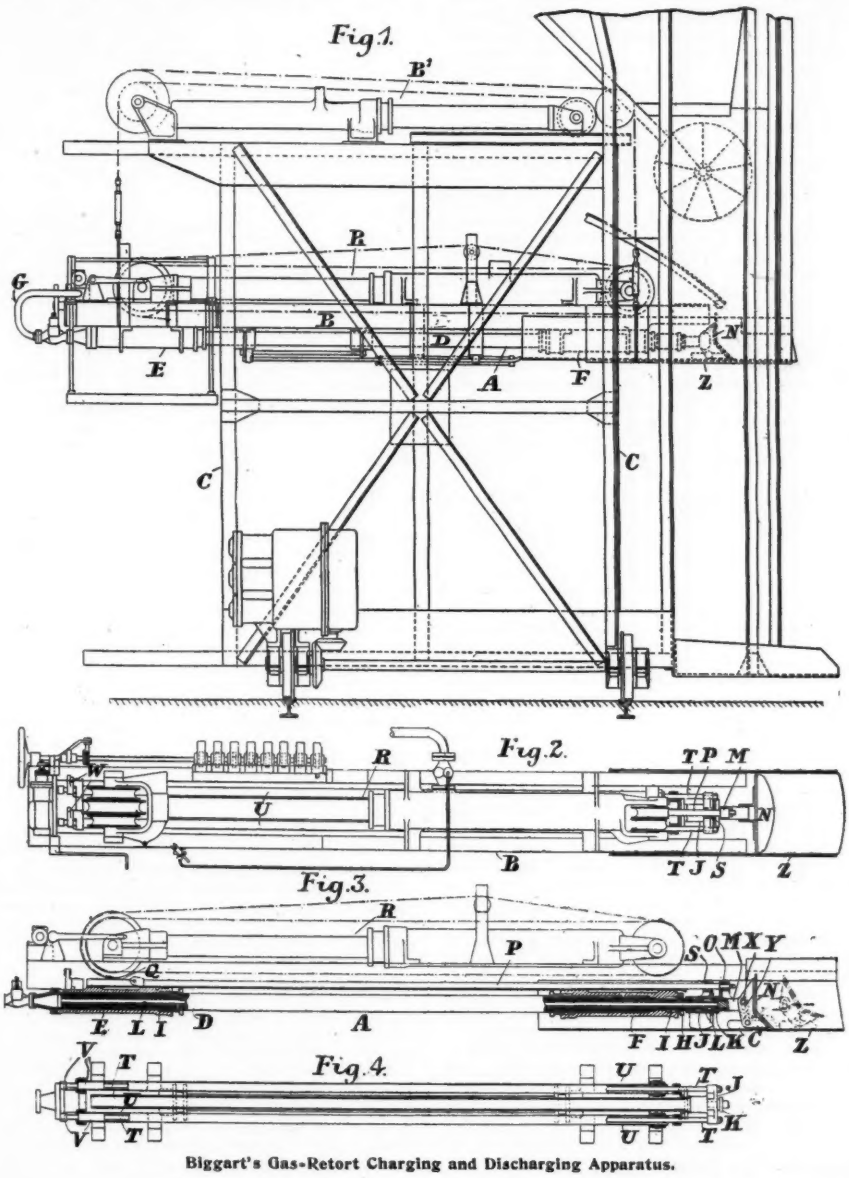
To enable the flow of gas to be stopped or started at will by the user so that the quantity of gas paid for and unconsumed can be utilized at different intervals, an auxiliary control tap is placed in the inlet pipe and provided with independent means for actuating the clock stopping and starting device. Preferably this tap comprises an ordinary conical plug provided at one end with a finger-piece and at the other end with a projecting lever, which can engage a lever (fig. 5) arranged in conjunction with the lever Z of the spring blade acting on the balance-wheel of the clock. With the closing movement of the tap, this lever is caused to raise the lever Z and so stop the clock; while with the opening movement the reverse operation takes place, and the clock is restarted.

Charging and Discharging Gas-Retorts.

BIGGART, A. S., of Glasgow.

No. 5974; March 10, 1910.

This invention relates to gas-retort charging or discharging machines of the kind comprising a travelling frame adapted to be traversed in front of the benches of retorts, and carrying a vertically adjustable beam fitted with hydraulic charging and withdrawing rams for forcing charges of coal delivered from a hopper into the retorts, and for drawing back the charging devices. The improvements are applicable mainly to the rams and relative parts carried by the rising and falling beam, and comprise (1) an improved construction of telescopic charging ram and of charging-head operated thereby; (2) devices fo automati



Biggart's Gas-Retort Charging and Discharging Apparatus.

cally locking part of the telescopic ram so as to cause it to act as a single ram when the retort is partially charged; (3) means for controlling the action of the withdrawing ram, which is coupled as usual to the charging ram; and (4) other details hereafter set forth—the whole arrangement being designed to adapt this class of machine for charging through retorts or benches of retorts from one end instead of by separate machines from both ends, and to permit of the same machine being used as a combined charger and pusher for discharging the coke from the retorts, or as a charger only.

Fig. 1 is an elevation showing a general arrangement of the apparatus. Fig. 2 is a part plan; fig. 3, a part longitudinal elevation part longitudinal section showing the charging and withdrawing rams and relative connections; fig. 4, a sectional plan of the charging ram and relative connections.

The charging ram A carried by the usual rising and falling beam B (operated by the ram B^1) on the wheeled framework C comprises an outer cylinder or long stationary tube D terminating preferably in end casings E F. The casing E is connected to a hydraulic pressure pipe G, and the casing F is formed with a stuffing-box H which serves as a guide for the outer tube I of a telescopic ram. This outer tube projects through the stuffing-box and is attached to a crosshead or guide-piece J through which is guided (in a stuffing-box K) the inner portion L of the ram which also is by preference tubular, in order that it may be cooled by the water operating it. The inner ram or inner part L of the telescopic ram is plugged at its forward end where it projects through its guide K on the outer part of the ram, and has secured to it a crosshead or spearhead M terminating in an elongated eye for attaching either of the charging head N or charger. This

crosshead M has also an upright arm O, to which is secured the end of a long rod P at whose opposite end is attached a chain Q coupled to the usual withdrawing ram R located above the telescopic charging ram. The rod P is guided through an eye S in the crosshead or guide-piece J on the outer part I of the telescopic ram. The crosshead J has two lateral arms to which are secured the ends of long rods T forming the plunger stops, and extending through open tubes U towards the outer end of the beam B or casing enclosing the rams where they are reduced in diameter or formed with collars V whereby they are locked or engaged by means of locking levers or catches W (fig. 2) automatically operated to prevent the telescopic action of the ram after a retort has been partially charged.

The charging head N or charger, which is loosely connected to the inner ram head or spearhead M by a pin X passing through the vertical slot Y in the latter, is composed of a bracket frame carrying on its forward end or face a plate of approximately oval contour to fit the usual sliding base or trough Z of the coal hopper which serves to bridge the space between the machine and the retort mouth. The plate at its lower end is bent or inclined forward so that in pushing forward the coal it is kept down in contact with the retort bottom. A shoe pivoted to the bracket frame at the rear of the face plate serves to guide the latter in its forward charging movement, and allows the plate and frame to tilt on its return movement so as to keep it clear of any pieces of coal in the retort (as indicated by dotted lines in fig. 3); the tilting movement being limited, if desired, by a stop on the plate co-operating with a stop on the shoe.

In the operation of the machine, the attendant on the operator's platform (attached to the rising and falling beam B) by turning a hand-lever opens a main valve to admit pressure water to the telescopic charging ram while exhausting from the withdrawing ram, whereby the outer part I and then the inner part L of the ram are projected forwards to the fullest extent, carrying the charging head N with a charge of coal, previously discharged from the hopper on to the bridging trough Z, into the retort and towards its farther end. The inner part L of the ram is stopped at the end of its traverse by a collar or enlarged end on the chain coupling rod P contacting with the guide-eye S on the crosshead J on the outer part I of the ram. The latter is stopped in like manner by the end collars V or plungers on the stop rods T attached to the crosshead J contacting with stationary lugs through which the rods T pass. The operator by reversing the hand-lever admits pressure water to the withdrawing ram R and exhausts the charging ram so as to bring back the charging head N to initial position. Each retort is only in part charged at each action of the rams; a succession of partial charges being required to fill the retort. The operation of the hand-lever actuates, as by means of link and lever connections, a ratchet (fig. 2) to rotate a shaft carrying a series of cams set each a little in advance of the one adjacent to it—these cams being arranged to operate in succession a series of stops which serve to limit the movement of the withdrawing ram R on its exhaust stroke and to limit correspondingly the outstroke of the charging ram A, so that each charge in succession is carried only to the requisite extent into the retort. Thus, if ten cams and stops are provided and successively actuated to reduce the exhaust stroke of the withdrawing ram by one-tenth at each action, the stroke of the charging ram will be correspondingly reduced, and the retort will be completely charged by ten gradually diminishing strokes of the charging head.

In order that the telescopic action of the charging ram A may be stopped when a retort has been charged over approximately half its length (so that the stroke of the inner part L of the ram suffices to carry the fuel forward in completing the charging operation), the guiding and stopping rods T attached to the crosshead J of the outer part I of the ram are automatically locked by engagement of the catch levers W with the stop rods T between the end collars or enlargements V, when a given number of charging strokes have been effected. For this purpose, the pivoted catch levers W are provided with hook-like ends and are linked or pin-jointed to a sliding bar which by the action of a spring normally tends to throw the locking levers W into engagement with the stop rods T, but which bar is adapted to be moved against the action of the spring so as to withdraw the locking levers W by means of a cam on the stopper shaft or other shaft actuated by or from the operator's hand-lever. The cam has a concentric portion, an inclined portion, and a radial end (somewhat resembling a snail cam), and in its slow rotation, preferably of a single revolution for the complete charging of each retort, the radial end, by bearing on the end of the sliding bar and pushing it inwards, keeps the locking catches W out of engagement. As the radial end clears the sliding bar, the latter is still kept in its inner position by bearing on the concentric surface of the cam; but when the inclined face is presented the sliding bar is free to move outwards under the action of the spring, and the locking catches W are thrown into engagement with the stop rods T to lock the outer part I of the ram A against further movement until the completion of the charging of the retort.

When the apparatus is used as a pusher for discharging the coke in the retorts, the various stopping devices are thrown out of action, and the telescopic ram is allowed to make a full stroke, so that the charging head pushes the coke right through the retort to the farther end, where it is collected in any usual way.

Extracting Tar from Gases.

BURSTALL, F. W., of Birmingham.

No. 4621; Feb. 24, 1910.

This invention deals solely with the extraction from gases of the lighter (in weight) tars and other impurities—such as tar oils.

Experience shows, says the patentee, that the outgoing gas from a tar-extractor of the kind wherein the tar is removed by beating the gas in contact with water—such, for example, as in a centrifugal extractor—contains a quantity of the lighter tars—such as tar oils—which are with the water, which has an affinity for these lighter (in weight) tars, beaten or mixed in such intimate contact and in such finely-divided conditions as to be practically in solution with each other and impossible of separation in all known forms and constructions of tar-extractors. The present invention, therefore, is intended to provide a method of extracting these lighter tars, and consists in passing the gas to be treated through one or more narrow, or thin, unbroken water sheets, formed and maintained by discharging under pressure one or more narrow

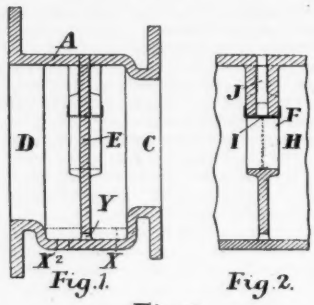
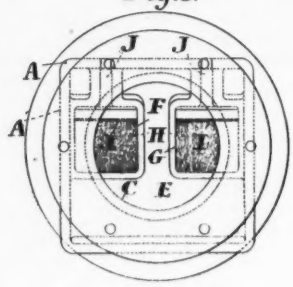


Fig. 1.

Fig. 2.

Fig. 3.



Burstall's Tar-Extractor.

streams of water entirely across a square or rectangular pipe or passage through which the gas to be treated flows. Such a method and means are diagrammatically shown in figs. 1 and 2 in sections, and in fig. 3 an end elevation looking from the right-hand side of fig. 1.

A casing A provides at C and D an inlet and outlet to and from the casing, which otherwise is enclosed. The casing between the inlet and outlet is transversely partitioned off at about its middle by a rigid wall E, through which are openings or passages F G extending parallel with the inlet and outlet. The thickness of F and G are represented in fig. 2; and it is in connection with them that the narrow streams of water forming the water sheets H are provided. It will be seen that each extends entirely across the passage for its full depth; is only narrow; and is formed by discharging water under pressure through a slit orifice or outlet I, which extends right across the opening or passage, and is fed from a pipe or other channel J, in a thickened portion of the wall E. It is necessary that these water sheets should be of comparatively small area—for instance, of approximately 6 inches square, or thereabouts, when of largest size—and that the water pressure should be somewhere about 25 feet head, so that the sheets can be readily maintained unbroken without leaving any bye-passages for the gas. It is also preferable to use the water over and over again, as such, if it contains the lighter tars (such as tar oils), has a greater influence upon those to be extracted from the gas.

The action is that the gas in passing through the casing must pass through the unbroken water sheets, which have the effect of extracting all the lighter tars by the natural attraction of the water in the sheets for the liquid which is in solution with the tars, and which tars are therefore washed out; the gas at the same time issuing in a drier condition, because it is relieved of the water which the lighter tars held in solution.

The water sheets are only about $\frac{1}{8}$ inch thick, and any number may be used—one behind the other if desirable. The water sheet is constantly and unbrokenly maintained by continuous pressure of the water which ultimately finds its way into the bottom X of the casing, as indicated by the water line, from which bottom it is taken off through a pipe X^2. The wall E near the bottom is formed with an "all across" opening Y, which maintains the same level of water in the bottom on either side of the wall.

Ending his specification the patentee says: No attempt is made to broadly claim the use of downwardly falling water in a sprayed or finely-divided condition to form a screen or veil, or the use of water flowing in sheet or rain-form entirely across a space through which air passes for its purification and cooling, as this has been hitherto proposed in connection with heating and ventilating systems. The present invention deals with a distinctly different problem—namely, the extraction of tar oils and such like from combustible gases which have previously been treated in a wet process machine for the extraction of the heavier tars; the substance of the invention being that, by passing the gas through an unbroken water sheet or, in other words, through a sheet which is never thoroughly broken through its entire thickness in consequence of the high water-pressure and the low gas-pressure, water contained in the gas, and which is in solution with such impurities as tar oils, is washed out to thereby leave the gas drier and more or less freed from tar oils or the lighter tars; the pressure of the water being of about 25 feet head, with the gas pressure from about 3 to 9 inches of water at most. The velocity of the water is very high compared with the velocity of the gas; so that the latter can only pass through the water sheet in small quantities in the form of bubbles, which, while piercing the water sheet in order to pass through, at the same time do not pierce the sheet right through its thickness, but only in such manner as to permit of the gradual passage being covered up. There is thus practically an unbroken water sheet at all times. The gas must not pass through in bulk, but just bubble or dribble through the water sheet.

Vertical Gas-Retorts.

ROBERT DEMPSTER AND SONS, LIMITED, and TOOGOOD, H. J., of Elland.

No. 9409; April 19, 1910.

This invention relates to settings for vertical gas-retorts. In such settings, it has hitherto been the practice, the patentees point out, to place the regenerator flues on each side of the furnace or producer, on one side of the setting; and the producer and regenerator flues have usually been built to the same height as the setting, so as to form a platform on the top of the retort-bench for stoking operations, and also to reduce loss of heat by radiation from the setting.

In the example shown, both the regenerator and the setting containing the retorts are divided into two distinct and separate compartments by the common wall A, of which the retorts B and the central vertical row of regenerator tubes form parts. Each of the compartments C D is provided at the outlet of the regenerator with a damper; so that the pull or exhaust, and, consequently, the amount of combustion in each compartment, may be regulated. The producer gas, as formed, accumulates in the producer-gas chamber E, which acts as a reservoir common to the several compartments of the setting. It is admitted into the setting through burners F arranged in the usual manner between the retorts. The secondary air is admitted to each burner through openings G. By suitably proportioning these openings, the quantity of gas and air, and therefore the heat generated, at each burner is controlled. The total products of combustion from the series of burners in the chamber C will be free to intermingle by setting up currents across the minor axis of the retorts, so as to better utilize the area of the retort walls, through which the heat units must be driven to

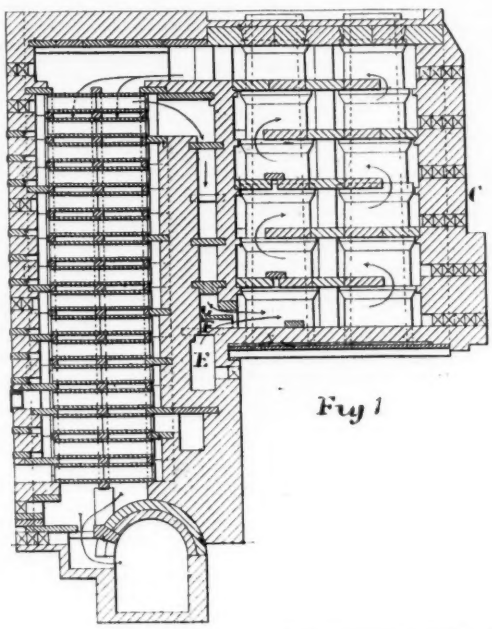


Fig 1

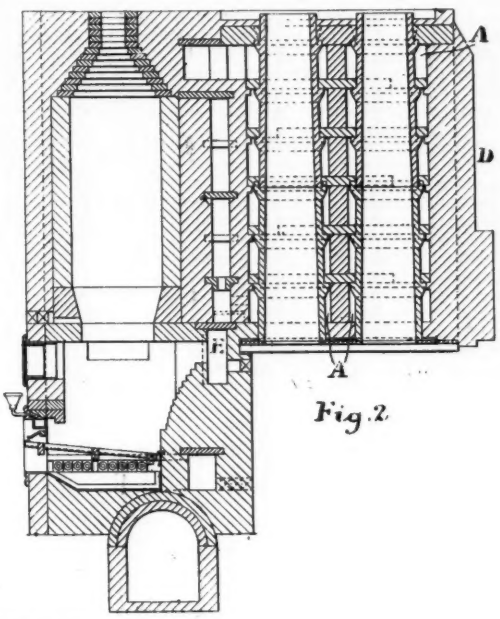


Fig 2

Dempster and Toogood's Vertical Retort Heating Arrangements.

carbonize the coal; and the same applies to the burners in the chamber D.

The general paths of the heating gases or products of combustion are indicated by arrows from the burners F zig-zag upwards through the setting, and by other arrows downwards through the regenerator and through the control dampers to the main flue.

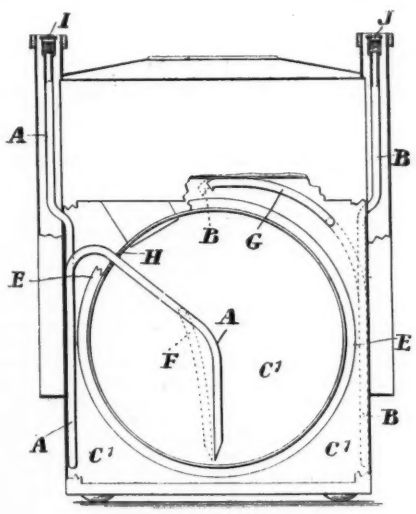
Dry Gas-Meters.

GLOVER, T., of Edmonton.

No. 8525; April 8, 1910.

This invention relates to appliances for supplying the bellows of a dry gas-meter with oil so that the leather is kept well saturated.

For this purpose, a pipe or tube is fixed inside either the inlet or outlet pipe of the meter (or there may be a pipe in both) leading either



Glover's Dry Gas-Meters.

into the bellows or into the body of the meter outside the bellows. Into the pipe or pipes oil is poured in such quantity that "each bellows or each compartment of the body of the meter is supplied with oil to have action on the leather or flexible part of the bellows which becomes saturated all over by capillary attraction."

According to the illustration, the pipe A conveys oil to the inside of both bellows, and for this purpose is conducted through the metal ring H into one bellows, and therein is provided with a branch F, which is passed through the division-plate C^1 into the other bellows. The pipe B conducts oil to the chambers and outside of both bellows; and for this purpose it is passed into one compartment, and a branch G is passed through the division-plate C^1. The ends of both the pipe and the branch are over the bellows, so as to convey oil to it. The pipes A B are bent so that, when filled with oil, the oil forms a seal to prevent any escape of gas. I J are screw stoppers for closing the pipes A B.

Rotary Gas Scrubbers and Washers.

CHANDLER, S., of Brixton Hill, S.W., and ROBERT CORT AND SON, LIMITED, of Reading.

No. 19,207; Aug. 16, 1910.

This washer scrubber is of the kind in which a number of boards or thin metal sheets of segmental form are made up into bundles with distance-pieces between for providing the gas-passages. A number of these form a wheel, which works within tanks divided either by partitions extending from top to bottom and having central openings in the divisions (as described in patent No. 4928 of 1877) or only at the lower part, as described in patent No. 422 of 1877.

The present invention was described and illustrated in the "JOURNAL" last month, *ante*, p. 522.

Nantwich Water Scheme.—A Local Government Board inquiry has been held at Nantwich with reference to an application by the Urban Council to borrow £3000 for experimental works of water supply in the township of Madeley, Staffordshire. The application was opposed by the Newcastle-under-Lyme Rural District Council and certain private owners, and by Dr. Reid, Medical Officer of the Staffordshire County Council. Mr. Baldwin Latham, who is acting as Consulting Engineer to the Council, said the site of the proposed works was acquired from the Earl of Crewe, and was in the watershed of the River Weaver, which flowed through Nantwich. The present supply had been condemned as inadequate; and the quality was not satisfactory. He denied that the proposed new works would affect the sources of supply of the Newcastle Authority. The works would cost the ratepayers nearly £20,000. Evidence was given, in support of the opposition, that the scheme would deplete existing sources of water supply in the Newcastle Rural Council's district; and the Staffordshire County Council asked that a protective arrangement should be made by the Board before sanctioning the loan.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Mr. Carr and the Standard Burner Bills.

SIR,—Mr. Carpenter, in his letter in your issue of the 28th ult., ignores my suggestion of a visit to Craven Street for the purpose of verifying (or otherwise) the figures of 4·6 candles which I give as the difference between the No. 1 "London" and the No. 2 "Metropolitan" burners, with the 15-candle gas supplied by the Gaslight and Coke Company.

It is quite true that the observations taken did not comprise complete tests for the prescribed period of ten minutes. The observations were, as I have already said, such as I was able to pick up during the time of the inspection of the apparatus by Sir Henry Kimber's Committee. But the observations, as far as they went, were accurate; and these observations, coupled with the knowledge of other comparative tests showing the difference between these two argands, made by various gas examiners with the gas supplied by the Gaslight and Coke Company, enabled me to establish in evidence that the difference is 4½ candles or thereabouts.

If I am wrong in this matter, surely demonstration (and not words) is the way to put me right; and the opportunity to do it is open to Mr. Carpenter whenever he likes to avail himself of it.

The promoters had stated in evidence that there was little or no difference betwixt these two argands. Had this evidence been capable of confirmation by a comparative test, nothing that I could have done or said would have prevented such a comparative test being made in the presence of Sir Henry Kimber's Committee.

Instead of having recourse to demonstration, Mr. Carpenter, forsooth, has the effrontery to lecture me on matters of accuracy and truthfulness. I trust, however, that my regard for, and observation of, accuracy and truthfulness in the work of expert witness, or other things, will bear comparison with Mr. Carpenter's. At all events, this is a matter I am prepared to leave to my compeers.

ISAAC CARR.

Widnes, March 4, 1911.

Will Mr. Isaac Carr Please Explain?

SIR,—Judging from the correspondence in your columns of the last few issues, Mr. Isaac Carr seems to be in an explanatory mood; so perhaps he will make some statement on the following.

In the year 1900 [see "JOURNAL" for May 15, 1900], the London County Council promoted a Photometer Bill; Mr. Carr being the only gas engineer to support the measure, but not the only one whose services were sought by the promoters.

Mr. Carr gave evidence that the gas supplied at Widnes was 18 candles; and at the present time it is given in the "Board of Trade Returns" at about this figure. Mr. Henry Woodall and others gave evidence to the effect that, unknown to Mr. Carr, they had, in a disused office in Widnes, tested the gas and found it as low as 12⅜ candles; and Mr. Carr is reported to have explained the discrepancy by stating that, at the time the tests by Mr. Woodall and others were made, he was "knocking his gas about" on the works. It is this that I would like Mr. Carr to explain.

Many of your readers will remember that at this period the Dinsmore process of enriching coal gas by distillation of its own tar was supposed to be in successful operation at Widnes, but a failure at all other places where it was tried.

On p. 31 of the Institution of Gas Engineers "Transactions" for the year 1909, Mr. Carr states that the No. 2 "Metropolitan" burner is "the means of throwing dust in the eyes of consumers and gas authorities generally." It would appear that dust can be thrown in many ways.

ALBERT R. CAWLEY.

Inverness Place, Cardiff, March 1, 1911.

Convection v. Radiation.

SIR,—Your correspondent "Nota Bene" takes me to task, in a most kind and complimentary spirit, which I fully appreciate, for some supposed inconsistencies in my paper recently read before the Liverpool Engineering Society [*ante*, p. 437]. On looking into his comments, however, I find that, instead of offering any serious criticism, he is in reality seeking for information; and this, so far as it is in my power, I am most willing to give him.

First of all, let me put him right as regards the respective utilities of radiation and convection. Before long, "Nota Bene" will come to recognize (as a great majority in the industry have already done) that my advocacy of radiant heat is not a fad, but a sound, essential principle, which has come to stay, and which has already done yeoman service in popularizing domestic gas heating for general use. When pioneer work has to be done in getting a new idea recognized and adopted, the only way is to din it into the public ear, in season and out of season; and it is by doing this that I have been able to make the progress I have done in convincing the industry of the advantages of radiant heat. The misconception seems to be that I desire to abolish convection altogether. But I could not do this, even if I wished. There will always be a certain minimum amount of convection, no matter how you increase radiation. What I do advocate is: (1) Concentrate on radiation, and get the most of it you possibly can; the convection will look after itself. (2) Construct your stove so that what convection inevitably remains after your most successful efforts for radiation shall be conveyed by a large volume of air at a low temperature, instead of by a small volume of air at a high temperature. The reason for this I shall explain presently, when dealing with the question of "dryness" of the air.

Then as to "Nota Bene's" impression that I favour radiation the one moment and convection (in the form of gas-radiators) the next. The two positions are entirely distinct and do not clash. My advocacy of gas-fires giving the greater part of their heat by radiation applies entirely to domestic and similar small apartments. The irreducible minimum of convection in such stoves is sufficient, along with the convection from the walls and furniture (which are heated by the radiation), to warm the air to a comfortable temperature. On the other hand, as regards large apartments, such as workshops, &c., the question of cost makes it first of all necessary to heat by some convection method, where all the heat is conserved for use in the apartment. Further, in such apartments, unlike domestic apartments, efficient ventilation can be provided without draughts, and independently of any fireplace flue; and again the element of chill from the cold walls does not come in, since the larger the apartment the greater is the proportion of air space to wall space.

Dealing more particularly with the matter of the feeling of "dryness" of the air through convection, your correspondent admits that this is caused by overheated air. That is precisely my case for radiation. Although the percentage of water vapour already present in the air is left, as "Nota Bene" suggests, unchanged by its passage over the convector, yet the air really is "drier," for the "dryness" of the air is determined by the relation between the amount of water vapour that can be held by it and the amount of water vapour actually present—*i.e.*, the degree of saturation. The amount of the former is entirely dependent on temperature. In the case under discussion, the temperature of the air is raised, and its capacity for holding water vapour is increased while the amount actually present remains constant. When this takes place, the air behaves, with regard to moisture, very much as a vacuum does. It seeks to take moisture rapidly to itself; and if no other source of supply be present than the human skin and mucous membranes, then from these the heated air will seek to satisfy its increased capacity for moisture, causing the consequent feeling of dryness and discomfort that I mentioned. The remedy, however, is not turning down the gas-tap (which would not reduce the proportion of convection, but merely let the room grow cold) nor yet having a bowl of water to supply water vapour; it is to have the room heated mainly by radiant heat (which, after all, is the method of heating by coal-fires, which accounts for their past popularity), and to have such a proportion of low-temperature convected heat as I have already described. If this is done, the percentage of saturation is not lowered very much, and the "dryness" of the air is not appreciably increased. In spite of the comparatively low air temperature, there is no discomfort due to coldness; for the walls, &c., being comfortably warm, there is no direct exchange of heat from the body to them.

Let it be borne in mind that, so far, I have been considering the case of domestic and similar small apartments. Should a room of this kind be heated by convection alone, it is on the air that the burden of conveying the heat falls. It takes comparatively little heat to raise the temperature of air, and, conversely, contact with a cold surface rapidly lowers the temperature of heated air. Since the walls, &c., have to be heated entirely by contact with air in this manner, it naturally follows that they remain colder than the air. In spite of "Nota Bene's" italics, the proximity of a cold wall does cause a feeling of chilliness, and for the simple reason that there is a direct exchange of heat between the human body and the walls, with the net result that the body loses some heat.

My statement that the "largest living-rooms" cannot be heated with the old-type narrower gas-fires remains quite unaffected by the experience "Nota Bene" reports. The matter of size makes all the difference. If his 14 ft. by 12 ft. room be one of the "largest living-rooms," what would be the dimensions of a really small one?

Let me remove "Nota Bene's" misgivings as to the cost of shallow gas-fires. The gas bills for many of these have been coming in regularly for several years; and to their extreme moderateness, combined with the efficiency of the fires through their high proportion of radiant heat, they owe the popularity which even "Nota Bene" frankly admits. These fires are so constructed as to do their work with a much lower amount of gas proportionally than the older types; and, indeed, they cannot profitably burn more than their fixed maximum.

As regards "Nota Bene's" suggestion that there is an odd 20 per cent. or so of heat units which is neither used nor lost, and which should be utilized, into what fourth dimension of space could it disappear? It is precisely this residual minimum, whatever its percentage, which, as low-temperature convection, plays its part in heating (but not, as when at high-temperature, overheating) the air of the room.

H. JAMES YATES.

Aston, Birmingham, March 2, 1911.

The Efficiency of Gas-Boilers for Domestic Uses.

SIR,—May we try to act as arbitrators in the controversy as to the best apparatus for heating by gas the hot water for domestic use. We have been "in hot water" since 1854, and therefore claim to have a slight acquaintance with the subject.

Mr. Yates votes for a combined storage and heater, which we should like to call a "circulator-cylinder;" and he proves his case by results obtained from testing a heater (which we call a "circulator") fixed to the ordinary flow-and-return pipes connected to a storage cistern or cylinder. It has been said that figures can prove anything; but I think something else is needed in this case. It is the desire of gas departments and apparatus manufacturers to offer the consumer something that will make the least upset in the house when being fixed, is economical, and is also neat and compact in appearance, and, further, easily removed on the tenant leaving. If the hot-water system is satisfactory, and the only reason for using gas is its undoubted advantages, there can be no question that the "circulator" is the best in every way.

We have to deal with systems as we find them. The existing arrangements are the landlord's property, and he may object to alterations. With the "circulator," there is no alteration of existing pipes. Branches are made which can be plugged up if the "circulator" is removed at any time. It is too late in the day to try and condemn the "circulator" for want of economy, as during the six years we have been supplying this apparatus the demand has increased continually; and we claim that, when tested against the net calorific value, we can show well over 95 per cent. of efficiency. There is loss of heat in the flow-and-return pipes, and also from the surface of the cylinder. But usually the pipes are in a wood casing or plastered in the wall; and if

the cylinder were lagged, or even wrapped with hair felt, the loss would be considerably lessened.

Now we come to the "circulator-cylinder," or storage and heater combined. These have their places, but not to the extent of the "circulator." In the first place, if the storage of hot water is insufficient, it can easily be supplemented by a "circulator-cylinder" of (say) 10, 20, 30, or more gallons; and so a defective system is improved. Secondly, if there is no hot-water system in a house, it would be wrong to put in a cylinder and connect a "circulator" to it. In such cases, the self-contained storage and heater is the ideal, as all that is required is a cold supply from a cistern at the top of the house, and a draw-off pipe from the top of the cylinder, having an expansion pipe carried from it.

The word "compensation" comes to our aid, and we would suggest it should be borne in mind when considering either "circulators" or "circulator-cylinders." It is only by realizing the corollary advantages that we keep a balance, and can squarely face so simple a problem as heating water by gas. Naturally, we should not be favourably disposed to any test of our apparatus made by a competitor, however much his human nature may be under control.

For WILSONS AND MATHIESONS, LIMITED,
JAS. W. WILSON.

Leeds, March 2, 1911.

SIR,—I have read Mr. Yates's letter on the above subject in your current issue, in reply to mine of the 15th ult. [*ante*, p. 534], and shall be obliged if you will allow me to make the following comments in regard thereto.

In the first place, his remark as to "absolute impartiality" is somewhat amusing, as it must have been very apparent to the heating world in general that my boiler and the others referred to were the subject of his criticism, which he subsequently confirms. As a matter of fact, it was first brought to my notice over the telephone by a representative of a gas company; and almost simultaneously a letter from a Liverpool firm of engineers arrived commenting upon it. Until then I did not know the paper had been given.

Mr. Yates evidently does not follow the course I have made a point of adopting in reading papers before the staffs of gas companies and engineering societies—viz., never to describe other makers' goods to their detriment; whereas he appears to have gone to the utmost possible limit in this matter by treating the subject upon a distinctly unequal basis, whereby the comparisons of efficiency are made to appear so unfavourable to certain boilers. I now notice Mr. Yates denies the comparisons he has adopted as being unfavourable, and puts forward the statement that I am under a misapprehension as regards the conditions of the tests. He may, however, readily be assured that such is by no means the case, as, though only a favoured few (not, of course, including myself) know the exact form of the apparatus as regards the respective positions of the boiler and the storage, in relation to the vertical and horizontal distances, because he does not produce a drawing showing it, he tells me that there is 17 feet run of pipe between the boiler and the storage, which information is sufficient for any practical engineer to calculate upon.

At this juncture, therefore, the absence of the drawing is of little concern, though it was inquired for at the reading of the paper, which indicates that some importance was attached to it; and one can only assume that it was omitted with a view to covering up the differences of conditions, as it would not have presented any more difficulty in drawing than the charts which are very much in evidence. I quite appreciate the fact, however, that it would have been impolitic for the diagram to have been published, as anyone conversant with the science of hot-water engineering, even in a modified form, would readily appreciate the fact of it being an unfavourable comparison; and the value of this part of the paper for the purpose for which it has apparently been written would have been *nil*. In the absence of the diagram, and being given the description only, there are few who would be able to place the full value on the question, as the point is not generally so well known as its importance demands.

In view of these telling facts, it will be open to question, to all those who are unbiassed in the matter, whether the paper was written with the strict impartiality claimed; and I leave all those interested to judge for themselves. I may say, however, apart from any statement already made, that any of the boilers referred to, whether of copper or of iron, would yield the highly efficient results claimed; and the principal gas companies, by their own investigations, know this to be the case. Therefore, in his exhaustive experiments, Mr. Yates arrives at different conclusions from many of the gas companies; but perhaps he considers the latter to be incompetent authorities in this matter.

Reviewing also Mr. Yates's description of the apparatus that formed part of the "separate boiler and storage" system he had in use with the "Victor" boiler, it is noticed that he makes contradictory statements in regard to detail. In his paper he informs his readers that the storage was of a 20-gallon tank; and he now says it was not a tank-system but a cylinder-system, and that I am under a misapprehension. I should therefore like to know his idea as to the respective purposes or uses of rectangular and cylindrical tanks in hot-water work, supposing that there is any fixed purpose or use for either, as his remarks appear to indicate. I would point out that the former may be suitable for a cylinder-system, or the latter be necessary for a tank-system, under certain conditions of pressure due to head of water; and since the subject, as we understand it, is new to Mr. Yates, this aspect of the case in point may not have occurred to him. In this connection, however, it is Mr. Yates who is under the misapprehension, as, in mentioning "tank apparatus" in my previous letter, I was calling attention to the fact of storage and circulation being adopted in testing independent boilers for efficiency; and as the arrangement of piping connections, which constitute what may be considered one of the chief differences between a cylinder-system and a tank-system, is of minor importance in this particular instance, having regard to the fact that no water is being drawn, it matters little which of the two happened to exist, as, for all practical purposes, knowledge of the distance of the pipe-run is sufficient for anyone well conversant with the subject.

Mr. Yates expresses astonishment at my remark that gas for domestic hot-water service is too expensive for continuous consumption. But this is well known to be the case by those who have had much experience on this matter among the householders of various classes. In this connection, I would call attention to the relative costs of gas and coal, which, heat for heat, it is only reasonable to expect must be somewhat different, seeing that gas is a manufactured commodity, and special means of delivering have to be adopted. Knowing that 90 per cent., or perhaps more, of the existing households are provided with coal-ranges and boilers, it follows that gas will not be used to the absolute exclusion of solid fuel, except, perhaps, in particular cases on the score of convenience, where undoubtedly it takes the lead before anything else. Some will use gas for everything; many will employ it moderately; while a few are met who will not take advantage of it at all. But the average housewife has to practice economy, and the necessity of a coal fire in the winter for personal comfort, or that of servants, as the case may be, is an important consideration; and it will be found, for this and other reasons, that she will not usually bind herself to the exclusive use of gas. I am speaking more particularly (as in my previous letter) of the ordinary dwellings of the average town middle class, not of flats, where, owing to confined space and general compactness, other conditions exist. In the case of the residences of the upper class one cannot claim a precedent either way, as it sometimes depends upon those in charge of the kitchen; the running expense being perhaps a minor consideration.

Knowing so well, from practical experience, the conditions surrounding the question, I do not consider it is for the benefit of the gas companies for them to be misled from the actual facts as they exist; and for this reason the matter has been referred to. It has been indisputably proved that such conditions do exist; and it is in consequence more in the interests of gas companies, when circumstances make it necessary, for them to advocate the use of gas in conjunction with the range fire, rather than to press for its exclusive use. Even supposing it were possible to utilize the gross heat of gas in water heating, the quarterly account in some households would be so increased—thereby directing attention to the comparison of cost between coal or coke heating and that of gas—that the custom for the latter would not be retained, even for supplementary use. In such circumstances, therefore, it is infinitely better to adopt the course here recommended, which has given so much satisfaction hitherto. In this matter I am speaking with "absolute impartiality," irrespective of party interests; and I could name many incidents in direct proof of it.

For the moment I am disregarding the fact of being a manufacturer of gas appliances, and thereby indirectly interested in the sale of gas; for I contend that it is the aim of all gas companies to adopt those principles which afford the best services generally to the public, as in doing so they are able to increase the number of clients for gas-heaters, and retain their custom—ensuring constant revenue therefrom, free from disputes, concessions, and other irritating incidents. Being a maker of a gas-boiler does not therefore justify one advocating the use of gas for entire and continuous heating in cases where it would not be for the benefit of the consumer. I have been asked to advise on many occasions when it would be absolutely detrimental to the interests of both the gas company and the consumer to do so, for various reasons which your correspondent's connection with this particular form of apparatus is probably too limited to enable him to appreciate. If "absolute impartiality" is observed in this respect, the gas industry will never be damaged, but stand its ground as one of the various means of heating. On the other hand, the maker of a gas-heated apparatus who advocates the employment of his particular product and the use of gas always, irrespective of his convictions, and represents the cost at less than it is possible to be, is the man who will endanger the gas industry, and very seriously, too.

Dealing with Mr. Yates's remarks as to the reason of the separate boiler and storage system being too expensive for general use, this point can be disposed of in a few words—viz., that it is a matter of construction; the result he quotes being obtained by the use of a particular form of apparatus. It must, of course, be recognized that, in the various dwellings with which gas companies have to deal, existing installations of a similar, or even less favourable, character to that which he has adopted are to be found, where, on account of initial expense, the necessary work in improving the conditions cannot be undertaken; and in such cases gas-boilers will not operate to the best advantage. In this way your correspondent, when he has experienced the use of boiler-storage apparatus, as seen in the average house, in relation to the working of a gas-boiler, will find some installations of such an unfavourable character that any of the boilers under test would appear even less efficient than he has stated them to be. But it does not follow that there is sufficient reason in this for the entire non-adoption of gas, as a boiler might fulfil a very useful purpose in assisting the range fire, which alone could not meet the demand satisfactorily. This is one very vivid instance where gas could not be used exclusively; and it will, I think, be appreciated generally.

These points are brought forward to show the difference of the conditions which were adopted in compiling the data composing the paper read at Liverpool, as, to be absolutely fair and equal, each and every heater, whether of the "independent" or of the "boiler and tank combined" type, should be tested separately, when the respective efficiencies could be truly represented. As it is, the less efficient one has been shown to the better advantage, though it is an indisputable fact, proved from the first series of tests quoted in my previous letter and the test No. 12 now given, that it is possible to obtain higher efficiency with the independent boiler than with the combined boiler and tank apparatus. It is interesting to note that the firm with which Mr. Yates is connected have apparently realized this, seeing that they are following our lead and that of others, at this late hour, in adopting a system which they are even now openly condemning! I presume, however, they have only recently discovered which is the more practical idea.

As regards the "cut-down" flame on a No. 13 "Victor" boiler, stated by your correspondent as being likely to deter many people from running an apparatus continuously, the provision of 12 or even 20 cubic feet of gas is sometimes required to meet special circumstances; and one can only assume that he cannot appreciate the whole depth of the subject he is treating. I do not propose, however, to go further than to say that the boiler which he so depreciates can be used with varying "reduced flames," which, if desirable, can be cut down to the 2·2 cubic feet limit that so much stress is laid upon, with even better

effect when the apparatus is jacketed. It is, however, interesting to note that the combined storage-and-boiler apparatus (without jacket) consumes 8 cubic feet of gas on the reduced flame, as will be seen by tests Nos. 8 and 9 given below, and not 5 cubic feet as claimed, which 8 cubic feet, in comparison with the No. 13 boiler working with a separate tank apparatus, meanwhile burning 12 cubic feet of gas, is distinctly unfavourable.

There are, of course, many ways and means of obtaining good results; and in the case of new installations, the opportunity is afforded to limit the length of circulation as much as possible, cover the apparatus, and take advantage of all the important features of construction, whereby economical working is effected. In such cases, one can show favourable efficiency; but when working under more or less adverse conditions, the lower value obtained does not cast any reflection on the boiler. This is a point I should like to direct special attention to.

Reverting to the question of comparison of "reduced-flame" consumptions in relation to a No. 13 "Victor" gas-boiler and a boiler and tank combined, which is stated to be 12 cubic feet and 2·2 cubic feet respectively, it would have been more to the advantage of the writer of the paper to arrange the apparatus in the former case with greater heating surface, when 20 feet, 25 feet, or any other figure desired, could have been quoted instead of 12 feet, as necessary with the "Victor" boiler. I could not let this point pass without comment, as, though most engineers would readily attach no importance to such an utterly absurd comparison, others who are not so conversant with this branch of engineering would be unable to discriminate between fair and unfair criticism. The point, of course, rests upon the question of heating surface, as with the former there is a certain length of pipe and detached storage, whereas with the author's apparatus with jacketed tank the same influences of heat loss are non-existent, and it is therefore only a question of temperature maintenance in the water; and a very small consumption consequently answers, except for the purpose of water drawn off.

There is, however, nothing particularly notable in these low "reduced-flame" consumptions, which I frequently use with "Victor" boilers, having luminous burners when working with a small and compact jacketed apparatus without secondary circulation, as would be the case in many flats, though the use of very small jets should be avoided when there is the possibility of their being extinguished by the action of draught. On this account, it is in some cases advisable to leave slightly larger "reduced" flames, of which adjustment our apparatus readily permits. All such matters, however, are subject to the conditions. So far as the question of jacketing is concerned, this has been recommended by me for years—in fact, long before the present-day gas-boilers were thought of; such arrangement having been published in my earliest catalogues.

Quoting the sentence in the early part of the letter under review, "If your correspondent had carefully read my paper, he would have found that the reason why users of *his* separate boiler-and-storage system find it too expensive for this necessary continuous use is the large amount of gas that has to be burned to maintain the system at the working temperature of 140° to 150° Fahr.," it appears to be indicated that a boiler-and-storage hot-water system cannot be worked economically. Assuming this to be the case, why are Messrs. John Wright and Co. proposing in future to adopt it in preference to their hitherto advocated combined arrangement, unless they intend installing new and entirely covered systems wherever their prospective boiler is to be used? If this is not their idea, they will have to acknowledge that a mean working temperature of 145° Fahr. throughout the apparatus is not maintainable with 2·2 cubic feet (or even with 5 cubic feet) of gas per hour; for with all circulating apparatus there are heat losses proportionate to the amount of surface exposed, and, apart from the question of drawn-off water, the gas required in maintaining the system at a given working temperature is regulated by this. It is therefore difficult to understand Mr. Yates's notion of the general principles of hot-water circulation; for his statements appear to indicate that the form of boiler used regulates every detail of consumption, whereas it bears upon the matter to a limited extent only.

Mr. Yates states, however, "that such a constantly available night-and-day supply can be economically assured is a matter of design of apparatus." From this it appears that it is his proposal to treat by reconstruction the various jobs with which he is concerned. This being so, the initial cost of installation will be invariably considerable, and in the case of a boiler used for a short tenancy, outside all common-sense ideas; for who is going to pay for the new apparatus, the landlord, tenant, gas company, or boiler makers? I can, however, readily understand their proposed departure from their combined system, on account of its general inadaptability of application to the average household, and the long heating-up period which has to be carried into effect throughout the apparatus, even though supplying only a small quantity of hot water. In this connection, the following test may be of interest:—

Combined Storage and Boiler Apparatus.

	Test No. 8, with 20 Gall's. Storage.		Test No. 9, with 30 Galls. Storage.
Temperature of cold water	48° Fahr.	..	48° Fahr.
Time from lighting until the gas shuts down	2 hrs. 15 mins.	..	2 hrs. 25 mins.
Amount of gas used when cut down	8 cub. ft. per hour	..	9 cub. ft. per hour
Temperature of hottest water drawn	150° Fahr.	..	154° Fahr.
Temperature of 15 gallons of water after it is run into the measuring-tank	144° ,,	..	148° ,,
Amount of gas used until the gas shuts down	62 cub. ft.	..	115 cub. ft.
	Test No. 10.		Test No. 11.
Burning 40 cubic feet of gas (time taken)	50 mins.	..	45 mins.
Temperature of hottest water	110° Fahr.	..	90° Fahr.
Temperature of 15 gallons of water after it is run into the measuring-tank	107° ,,	..	86° ,,

It will be seen from the foregoing that upwards of two hours elapse before the thermostat comes into action. It is necessary to wait this time to obtain any hot water, however small in quantity, as may often be required at the sink; whereas with our particular form of apparatus such purpose is effected in 15 or 20 minutes, according to the quantity of water wanted and the particular size of boiler in use. Furthermore, our apparatus readily admits of reducing the quantity of water in circulation; so that for occasions when there is less general demand for hot water, or the bath is not in use, a considerable saving can be effected, due to economy in heat losses and other influences. With my complete appliances in their standard forms, the thermostats come into action within 1¼ hours of lighting the gas; while for bath purposes, taking No. 4 size, with the "Victor" No. 13 boiler, as an example, a single bath can be obtained in the summer in 20 minutes after lighting the gas, or in 30 minutes in the winter, affording hottest water at a temperature of 140° Fahr., or, with successive heating, four baths in 65 minutes after lighting the gas in summer, or in 1 hr. 50 min. after lighting the gas in winter.

The consumption of the shut-down flame with the smaller apparatus in the test just given (8 cubic feet) appears to be at variance with your correspondent's statement of 5 cubic feet. This indicates that the automatic valve is improperly adjusted, or that the boiler is of a very low efficiency.

To anyone conversant with the measurement of heat emission, however, the latter point can be readily calculated, supposing for the purpose that a standing temperature of 150° Fahr. is maintained. Under average conditions, assuming an air and water temperature difference of 100° Fahr., using 8 cubic feet of gas with the 20-gallon cylinder, 206¼ B.Th.U. per cubic foot of gas are being utilized; while supposing 5 cubic feet of gas is being consumed, 330 B.Th.U. are picked up. If the latter, much less the former, is the maker's idea of how "a constantly available night-and-day supply can be economically assured," I congratulate myself upon having adopted a different scheme, as for a complete apparatus a low rate of efficiency is shown, and one that would most certainly prevent the continuous and exclusive use of gas for domestic supply.

Taking an important item from the discussion on Mr. Yates's paper, reported in the "JOURNAL," it does not appear that a favourable impression as regards gas for heating water was conveyed to the meeting at Liverpool; the chief point of criticism in relation to this subject (apart from that concerning my boiler) showing that, according to the paper, it would be necessary to expend a monthly gas consumption to the relative price-value of a ton of coal in maintaining the night-and-day supply that is so much talked about. I note, however, that your correspondent could only reply to this very reasonable remark by saying that "the hourly consumption could be reduced to as low as 2·2 cubic feet, which was sufficient to maintain the water at the required temperature." But this could not have been a satisfactory reply to any of those present who had followed the subject through; and, from the facts regarding the heat losses, &c., hereinbefore stated, it is shown to be quite inaccurate. This definitely proves my point that gas burning continuously works out too expensively in many cases, and further goes to show that a system whereby hot water can be obtained at intervals, and that quickly, is oftentimes of the greater advantage; one important factor being that continued heat losses are avoided. I can speak from definite experience in this matter, and know such to be the case, having under my notice many examples where the entire gas account, both for cooking and water heating—including water drawn, waste, heat losses, and all other influences—is considerably less than the amount your correspondent's paper has led his hearers to believe is wasted in temperature maintenance alone. Surely his statement is not represented to be to the interests of the sale of gas; and I am more than astounded that a maker of gas appliances should put forward such unfavourable argument, even if it was correct.

As regards his remarks on the principle of my test, I could write at considerable length. I must, however, at the moment, defer this, on account of limitation of space; and I therefore propose, as an example, to deal with one only—viz., Test No. 6, using "Victor" boiler No. 1. The test referred to deals strictly with boiler efficiency, and has no reference whatever to the storage of a body of heated water; there being no return-pipe, tank, or cylinder, so that Mr. Yates's comments on this point immediately collapse. It may not be known to him that gas companies are now in many cases very reasonably testing boilers upon an equal basis to geysers; and the test in this case is of the same character—passing water at a given rate through boilers, and taking the actual difference of the inlet and outlet, whereby the power, apart from any outside influences, is truly recorded. This is what I consider to be "absolute impartial" comparison; and had your correspondent acted in a like manner in dealing with the subject, this controversy would not have been made necessary, though, perhaps, from the interesting facts it has brought forward, an indirect benefit will result.

As a comparison of efficiency between the "combined boiler-and-storage" system and the "separate" system, in the former case a Wright's apparatus and in the latter a Potterton's, both having a cylinder of 20 gallons capacity, both unjacketed, both using water at 50° Fahr., and both consuming the same quantity of gas (equal conditions throughout, mark you), the following figures taken from a test for bath supply may be of interest.

Test No. 12.

	Temperatures Taken in Bulk in Tank.		
	Wright's Combined Apparatus.		Potterton's Complete Apparatus.
40 cubic feet of gas consumed, 20 gallons of water run into the measuring-tank	100° Fahr.	..	112° Fahr.
Continuing—70 cubic feet of gas consumed (further 30 cubic feet), 20 gallons of water run into the measuring-tank.	98° ,,	..	109° ,,
Continuing—100 cubic feet of gas consumed (further 30 cubic feet), 20 gallons of water run into the measuring-tank.	100° ,,	..	120° ,,

The foregoing figures show how unreliable comparison of tests are likely to be unless the conditions are precisely similar, as the informa-

tion imparted by your correspondent reads as though the results should really be the reverse of those which are shown. This, however, goes to prove how valueless are the results he published concerning "*my*" system, so far as the piping and storage are concerned (which, it may be incidentally mentioned, is not *mine* at all, but his), either as his notion of a hot-water apparatus as it should be, or his representation of my idea of it; and I challenge him to show in my catalogue of gas-boilers, which catalogue also gives full particulars of the stock size complete apparatus, where I quote for, or offer to supply, the apparatus such as that which he has adopted—viz., a No. 13 "Victor" boiler and a 20-gallon cylinder, *with 17 feet flow and return pipe*. Failing his ability to do this, I would ask him to justify his statement that the apparatus he has on test, "apart from the Victor boiler," is *my* "separate boiler-and-storage" system; for he openly states, in his letter published in the last issue of the "JOURNAL," that such is the case—see the following words: "If your correspondent had carefully read my paper, he would have found that the reason why users of *his* separate boiler and storage system find it too expensive," &c. Further than this, I may say that a 20-gallon cylinder and a No. 13 boiler are not proportionate, and not used together by me; the one being too large for a given purpose if the other is properly suited, or *vice versâ*. Here again, therefore, Mr. Yates goes astray. There may, of course, be instances where the storage is placed, by those who erect the apparatus, at even a greater distance from the boiler than that with which your correspondent is working to meet certain purposes or conditions; or supposing, for example, a boiler is being applied to an existing installation which is not quite upon the lines we should adopt. But such circumstances do not constitute any precedent in the matter, as my apparatus, as illustrated in my catalogue, is of definite construction in this way, and does not vary unless particular circumstances make it necessary. Mr. Yates cannot have experienced the use of one of my installations, or he would not make such an utterly absurd statement. In direct denial of it, I should like to be allowed to give you the addresses of a number of my clients, who will refute such ridiculous ideas; and had I not personally been able to do so through the medium of your columns (for which please accept my appreciation and thanks), it could not but have been damaging to my reputation as a heating specialist, and my professional connection as consulting engineer among the various gas companies, architects, general building and engineering trades of this country, and those of India and Japan and other countries, with whom I have business connections.

It is now common knowledge that the firm your correspondent represents is taking up this branch of hot-water work. I have built up a connection upon the merits of the articles I have put on the market, and upon my experience as to their most effective use. Cannot, therefore, Mr. Yates do the same, instead of adopting the line of campaign which he has done, to the disadvantage of other makers of independent gas-boilers and myself, between whom the most friendly and congenial relations have always existed, and for my part will continue to do so? So far as the question of the making of independent gas-boilers is concerned, I should be the last to offer protest against anyone doing so; contenting myself with that old adage: "Imitation is the sincerest form of flattery." But when an attack (justifiable or not as it may be) is directed against those already in the field who have done considerable pioneer work, as I claim to have done, it is "up against" them to lay the facts bare as they appear. This accounts for my taking part in this distasteful affair; for I contend that there is room for all, as, provided the question of gas-heated hot-water supply is treated upon commonsense and practical lines, the advantages afforded by the use of gas, whether for occasional or continuous duty, as circumstances may regulate, will become so universally known that this commodity, in which so many of us are directly or indirectly interested, will be in greater demand than ever was anticipated.

Before concluding, I wish to state that the facts represented by the writer of the paper and letter mentioned are absolutely erroneous in so far as they refer to my appliances; and, further, that "my" apparatus (or system), or whatever name he may apply to it, is of the most efficient type, both in principle and design. He infers also that the apparatus does not lend itself to covering. This, however, is one of its most salient features; and those of your readers who know a true "Potterton installation" will be able to take this statement for what it is worth. For confirmation upon this point, I would refer you to the "Victor" complete apparatus (the "real" thing), as fixed in the Kensington, Edgware Road, Golder's Green, and Horseferry Road show-rooms of the Gaslight and Coke Company, and in the Old Kent Road, Lewisham, Catford, Clapham, and Streatham show-rooms of the South Metropolitan Gas Company (without supplying hot water in many cases for staff requirements). These appliances, almost without exception, are jacketed on my special system. Why, therefore, Mr. Yates should continue to make such affirmations, which indicate that either he is entirely ignorant of my particular principles, or that he has ulterior motives at heart, I fail to understand. My remarks hitherto have dealt with the aspect of his paper as it affects me. But on a later occasion I may have an opportunity of reviewing the paper from another standpoint. Meanwhile, I must thank you in anticipation of your kind indulgence in the matter of granting me space in your columns.

Balham, S.W., March 2, 1911. THOMAS POTTERTON.

Reductions in Price.—The Newport (Isle of Wight) Gas Company have reduced their price 2d. per 1000 cubic feet from the commencement of the year; bringing it down to 3s. 6d. The Wellingborough Gas Company, Limited, have also reduced their price 2d. per 1000 cubic feet, to take effect after the reading of the meters at midsummer.

Coke-Oven Gas for Sutton-in-Ashfield.—According to a local paper, the New Hucknall Colliery Company are erecting some 70 or 80 coke-ovens of a new type, to be fired on the regenerative principle. There will be a large yield of gas from these ovens, and it is stated to be the intention to offer it to the Sutton-in-Ashfield Urban District Council in bulk at such a price as will place this authority in an almost unique position with regard to the sale of gas at a very low figure. This will be of special value to the users of gas for power.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills read a second time and committed: Merthyr Tydfil Corporation Water Bill, Rhymney Valley Water Board Bill.

The Chapel-en-le-Frith, Chinley, and District Gas Bill, Chesham and District Gas Bill, and Whaley Bridge Gas Bill have been referred to a Select Committee, consisting of Lord Southwark (Chairman), Viscount Falkland, Lord Gwydir, Lord Ellenborough, and Lord Willingdon; to meet next Tuesday.

The Ashborne and District Gas Bill, Ely Rural District Water Bill, Hastings Corporation (Water and Finance) Bill, Luton Water Bill, and Slough Urban District Water Bill have been referred to a Select Committee, consisting of Lord Newton (Chairman), the Earl of Malmesbury, the Earl of Westmeath, Lord Seaton, and Lord O'Hagan; to meet next Tuesday.

The Chester Water Bill, City of London (Various Powers) Bill, Harrogate Corporation Bill, and Sidmouth Gas and Electricity Bill have been referred to a Select Committee, consisting of Lord Kintore (Chairman), the Earl of Leven and Melville, the Earl of Hardwicke, the Earl of Verulam, and Lord Tennyson; to meet on Tuesday, the 21st inst.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bill presented and read the first time: Halifax Corporation Bill.

Bills read a second time and committed: Chichester Gas Bill, Gaslight and Coke Company Bill.

The Select Committee of which Sir Harry Samuel is Chairman was to have met last Thursday to commence consideration of a group of Bills in which were the Marple Urban District Council Bill, the Bicester Urban District Gas Bill, and the Chesterfield Gas and Water Bill. Prior to the day fixed, however, the Marple and Bicester Bills became unopposed; and the Chesterfield Bill was removed from the group. As the remainder of the Bills in the list—viz., the Chichester Gas Bill, the Gaslight and Coke Company Bill, and the Tamworth Gas Bill—had not been read a second time, they could not be proceeded with; and the Committee consequently did not meet. The Barking Urban District Council have withdrawn their petition against the Gaslight and Coke Company Bill, which is down for consideration by the Select Committee on Thursday.

LEGAL INTELLIGENCE.

A Water Supply Dispute.

A dispute between Mr. A. Rasey and the Wokingham Water Company was brought to a crisis by the Company cutting the water off from Mr. Rasey's premises. Proceedings were taken by the latter; and the case was heard at Wokingham Police Court on Tuesday last. From the evidence given, it appeared that the complainant built stables for his two horses on a plot of ground upon which, two years later, he erected a cottage. The stables were formerly assessed separately from the house; but this year the rating authorities, for convenience, assessed the cottage and stables together. These out-buildings were approached by a side entrance; and the water consumed there was obtained from an adjoining well, while the Company's water was only taken for the cottage. The Company had increased their charges on account of the two assessments being combined; and to this the complainant had objected. The Magistrates decided that the Company were entitled to charge upon property according to its assessable value. Mr. Rasey had the power to use the water on the whole of his property; and though he only did so for his house, the Company were perfectly within their rights in charging for the entire property. Each side had to pay its own costs.

Dangerous Act of a Slot-Meter Thief.

On Wednesday last, in the Glasgow Southern Police Court, Robertha Mathieson or M'Kessach was charged with having, on Feb. 8, stolen 2s. 11d. from a prepayment gas-meter in the house she occupied at No. 334, Mathieson Street, and with having maliciously pulled down the meter, broken the gas-pipe, and allowed the gas to escape, to the danger of life and property. She pleaded not guilty, and the case went to trial. From the evidence, it appeared that an ejectment notice was served upon the accused on Jan. 27, but that she did not begin removing from the house till Feb. 6. About eight o'clock in the evening on Feb. 8, she and two women were seen to leave the house together. A few minutes later, the accused returned; and when she was in the house the neighbours heard a noise as if some heavy article had fallen on the floor. This appeared to have been the meter. The woman left the house shortly afterwards, and did not return. About half-an-hour later, a strong smell of gas was noticed in the tenement. The smell got more pronounced, throwing the inhabitants of the tenement into a state of alarm. The Gas Department were communicated with, and a man arrived; but he found great difficulty in getting the door and windows opened, on account of the overpowering smell of gas. He was unable to enter the house to cut off the gas, and was obliged to break through the wall. Bailie M'Lean, who presided, found the charge proved. He characterized the act of the accused as diabolical, as it might have been the means of wrecking the building and killing a number of people. He imposed a fine of 21s., with the option of 14 days in jail.

MISCELLANEOUS NEWS.

KIRKCALDY GAS-WORKS PURCHASE ARBITRATION.

Further Evidence.

The proceedings in the above arbitration (*ante*, p. 614) were resumed at the Surveyors' Institution on Monday and Tuesday, the 27th and 28th ult., when, as mentioned in the "JOURNAL" last week, Mr. W. R. Herring continued his evidence for the Corporation.

The Arbiters are: For the Company, Mr. CORBET WOODALL; and for the Corporation, Mr. ARTHUR SILVERTHORNE. They nominated Lord SHAW OF DUNFERMLINE as Oversman. Mr. NORMAN J. MACPHERSON, S.S.C., is Clerk to the Referee. The Company are represented by Mr. MURRAY, K.C., and Mr. MONCRIEFF (instructed by Messrs. Adamson, Gulland, and Stuart, of Edinburgh); and the Corporation, by Mr. CLYDE, K.C., M.P., and Mr. MACMILLAN (instructed by Messrs. Morton, Smart, MacDonald, and Proser, of Edinburgh, and Messrs. Martin and Co., of London).

Mr. *Herring* put in a statement showing the cost of coal and other data of Scottish works in the neighbourhood of, and subject to the same commercial conditions as, Kirkcaldy. He had selected four places—namely, Alloa, Falkirk, Perth, and Dunfermline. The average coal cost of the four comparative towns was 10s. 6d. per ton, as compared with 13s. 5d. in Kirkcaldy. No reason occurred to him why Kirkcaldy under moderate conditions should buy coal at 13s. 5d. per ton whereas the other four places bought it at 10s. 6d. The only reason that suggested itself to him was that they had not exercised that keen business instinct in buying that a statutory company would have to exercise in order to pay its dividend. So long as they were getting 3s. 2d. per 1000 cubic feet for their gas and were paying a 7½ per cent. or an 8½ per cent. dividend, there really was no inducement. They were in the position of the gas companies in the olden days before the sliding-scale was in operation. After it was introduced, the interests of the consumer and the gas company were mutual. There was one particular figure he wished to mention, and that was that the net cost of coal in the four towns was 3s. 10d. per ton, as against 8s. 9d. in Kirkcaldy. This was accounted for by the fact that Kirkcaldy did not recover as much from the sale of their bye-products as the other towns did; and so they not only paid more for their coal, but, as they recovered less, their cost was necessarily much higher—in fact, it was more than double. In Alloa, the net cost of coal was 4s. 8d. per ton. So far as coke was concerned, Kirkcaldy was equally well placed if they had the facilities for handling it. At Alloa, they manufactured the ammonia products into sulphate of ammonia, and thus recovered a profit on it. Kirkcaldy had to cart this product from their works to the railway station, and then rail it to Falkirk. So they were not recovering under this heading what they might easily recover. This was owing to want of plant, which for some reason or other the Company had never thought fit to put down. On the other hand, owing to the cramped conditions, the Company could not store their coke. They were in the habit of sending it to Edinburgh, and selling it at 1s. per ton less than the Edinburgh coke—paying 3s. per ton carriage on it. This was a striking example of how the insufficient premises and inefficient arrangement of the premises affected the cost of the coal. In his opinion, the present price of gas in Kirkcaldy was having the effect of keeping the consumption down. In other words, he thought it was much too high. During the last three years, there had only been an increase from 146,485,000 to 147,881,000 cubic feet of gas made. This represented on the average ¼ per cent. per annum. He thought an undertaking measuring its quantities in millions that was only increasing ¼ per cent. per annum could be said to be standing still. Witness put in a table showing the price of gas to ordinary consumers in Scottish towns of 2000 inhabitants and upwards. Kirkcaldy appeared at the bottom of the list. Apparently, if they took present prices, Kirkcaldy was the highest price company in Scotland; there being only one higher than 2s. 10d. or 2s. 11d.—namely, Ayr, at 3s. 1½d. The Kirkcaldy Company was the only one in Scotland who had increased their price between 1896 and 1910. All the others had decreased their price—in many cases by very considerable amounts. Whichever way they looked at it, the contrast between Kirkcaldy and the rest of Scotland, in the case of towns of 20,000 inhabitants and upwards, was very marked. In the case of Dunfermline, which happened to be the second highest case of a reduction between 1896 and 1910, they were charging 2s. 3d. per 1000 cubic feet; whereas Kirkcaldy, next door, were charging 3s. 2d. In Falkirk, the price was 2s. 9d., and in Stirling 2s. 6d. Besides the price of 3s. 2d., Kirkcaldy recovered 1·38d. per 1000 feet for ordinary meters. The comparison only accentuated the high price which Kirkcaldy charged as compared with other places. The Company had been allowed to go on without control. They had been able to charge a high price without much restraint. They did not want to increase their consumption, because if they had done so they would have had to face a scheme for the reconstruction of their works. They were much better financially to jog along on the present footing—building up their reserves and increasing their dividend on the capital. He could not say that he had ever known, in the case of any other company, the practice of making the consumer provide the capital, and then pay interest on the capital, carried to the extent it had been with this Company. He found that the four comparative towns named received 6s. 8d. per ton of coal; while Kirkcaldy only got 4s. 8d.—the difference being equal to 2·8d. per 1000 cubic feet sold in Kirkcaldy. Taking the actual cost of coal in 1910, in Kirkcaldy it cost, after allowing for residuals, 4s. 11d. per ton net more than its neighbours, or 7d. per 1000 cubic feet on the cost of the gas sold.

By the OVERSMAN: The disturbing fact with regard to Kirkcaldy was that relatively the receipts for residuals per ton were much less there. If witness had been managing these works, he thought he could have bought coal cheaper than Kirkcaldy did.

In further examination, witness produced a statement relating to Scottish gas undertakings in towns of over 20,000 inhabitants. It showed the average price of gas, mainly in 1908-9, to consumers to be 2s. 8d. per 1000 cubic feet. The present price on the average was 2s. 6·4d. The Company in this case were asking from the Corporation a price of £224,000. The money which this would require to be raised for interest and sinking fund would be £11,200 per annum at 5 per cent. The charge which this would impose per 1000 cubic feet would be 21·5d. At this rate, no gas undertaking at the present day could hope to exist. Witness also put in a joint valuation by himself, Mr. Hunt, and Mr. Simpson. With regard to the gasholders, the difference between them and the valuation of the other side exceeded £2000. In his opinion, No. 1 gasholder was useless; and therefore he did not allow anything more than scrap value for it. As to the mains, his total valuation was £70,493, as against their £103,000. £10,000 was accounted for in the difference of the land. His deductions for rents (£298 4s. 3d.), deficient expenditure (£338 10s.), and an allowance from the profits for the extra price charged for gas (4d., reducing the price to 2s. 10d.), amounted into £2720. Deducting this amount from £6550 13s. 4d., the profits of last year, left a maintainable profit of £3830. The Company could not hope to keep the price above 2s. 10d. He agreed with Mr. Cockburn Millar that if they valued on the basis of the present market prices of similar stock they would get a figure of 18½ or 19½ years' purchase. At his 21 years' purchase, he got a figure of £80,430; but over and above this, he dealt with certain deductions for deficient plant and certain additions for property and excess plant in his valuation. The total deductions came to £7611; bringing the valuation down to £72,819. There were, however, various allowances made; and the final figure was £79,457.

In cross-examination by Mr. MURRAY, witness said the question of purification was merely one of fulfilling a certain obligation to the public. He recommended more purifiers, because he saw by the results that there was a great risk of the Company transgressing the general conditions applicable to gas making. The main factor in determining the purifying area of a box was the speed with which the gas was made to travel through it. There were special conditions in Kirkcaldy to be considered by reason of the amount of carbonic acid—2·5 per cent. was 1 per cent. higher than usual. It was the case that in England the average composition of the gas was 2·5 in terms of carbonic acid; but by the time the gas got to the purifier, some of the carbonic acid had been taken out—as much as they could get out in the washers and scrubbers. The carbonic acid in the gas originally was 3·42 per cent.; and Counsel would find no English coal yielding such a high percentage. Witness did not agree with Professor Vivian B. Lewes that the average composition of gas after leaving the scrubbers, in terms of carbonic acid, was 2·5 per cent. The presence of carbonic acid reduced it by two candles, giving about 10 per cent., which would be roughly another 4d. on the price of gas.

Mr. MURRAY: Is not the position this—1d. for diluent and 4d. for loss of candle power, which is 5d. in all gained to the consumer in Kirkcaldy, against your suggestion?

Witness: I do not admit your assumptions at all.

Replying to further questions, witness said, with regard to the gasholders, the amount of gas in hand in the 24 hours, distributed among three holders, was as follows: Sunday, 341,000 cubic feet; Monday, 246,000 feet; Tuesday, 347,000 feet; Wednesday, 322,000 feet; Thursday, 32,000 feet; Friday, 312,000 feet; Saturday, 281,000 feet. During the month of December, the Company's books showed that they had 80 retorts out of the 104 in use, and they made 9909 cubic feet per ton of coal, or a total of 736,000 cubic feet. The records of the Company showed a wonderfully consistent return of gas per ton of coal carbonized, and this although there had been a change in the quality of the coal. By taking off the counterbalance weight, they could increase the pressure in Pathhead at will. The old condenser was not sufficient for use as stand-by; it was too small. The Company had two condensers. The new condenser was the effective apparatus on the works. Certain meters were not stamped; and he had very great fears as to whether the consumer who could prove that he had an unstamped meter could be forced to pay his bill. It was a legal point except in so far as it involved the cost of having the whole of these meters examined—taken out and sent to Edinburgh to be tested. He would almost go so far as to say that the "Metropolitan" burner No. 2 produced the same results irrespective of the kind of gas that it burned. The conditions under which Mr. O'Connor secured his test of 12·89 candles at Alloa with a No. 1 argand burner were calculated to give wrong results in all cases. From his (Mr. Herring's) knowledge of the prices of coal, he rather suspected that the Kirkcaldy Company paid more than they need have done. In regard to the price of gas, the Company since about 1902 had been subjected to electric light competition in Kirkcaldy. It was certainly open to the consumer to go to the electric light; but he thought that electricity in Kirkcaldy would cost the consumer more for a given amount of light than gas used in an incandescent burner. In witness's table of prices, Edinburgh started with 3s. and rose to 3s. 4d., then went down to 2s. 9d., then back to 3s.; and it was only the other day that the price was reduced from 3s. The alternate rises were in consequence of the price of coal. There was no question of loss of revenue as the result of reducing the price. Dunfermline, since the purchase of the works by the Corporation, had almost doubled their output; but he could not say whether it was the case that this had been done without increase of capital charges. The resultant difference between witness's structural valuation and that of Mr. Woodall and Mr. Stevenson was £70,000, as against £103,000. Substantially the difference was accounted for in the main in respect that witness had taken depreciated values for gasholders, mains, meters, and services, which came to about £14,000; making £84,000. The addition of the difference between the land valuation brought this up to £94,000; so that, after giving effect to these things, there was not so great a difference between them after all. The price witness proposed to pay the Company was £79,000. The value of the undertaking they had ceased to consider, having arrived at the maintainable profits. They were merely buying the profits. If it was correct that there was £11,000 in sovereigns, his valuation came down to £68,000. Hitherto he had refused to consider the peculiar history of the Company. He would prefer not to accuse the Company of indifference and want of commercial knowledge in the control of their undertaking. But this was what it really came to.

There should be increased pressure; and his whole report was on this assumption.

Replying to Mr. WOODALL, witness said it was in his mind that, if this increased pressure had taken place, it would have popularized the use of gas, and there would have been a considerable increase in the consumption.

By the OVERSMAN: There were 13,067 shares of the Company; and if the value of the undertaking and all the property came to £79,497, this was equivalent to a value of £6 11s. 5d. per share. The reason why people had been paying from £9 to £10 5s. per share was that on the market the stock of the Company had always carried with it the bonus prospect.

The OVERSMAN: Do you think it is right to ask people who are parting with their property, and who have paid for it from £9 to £10 5s. for their shares, to accept, in lieu of the property which they have just bought, £6 11s. 5d.?

Witness: No; I do not believe in confiscation. I think the shareholders are fully entitled to their profits; but I cannot admit that, at the very outside, and on the most generous terms, they are entitled to any more profit than that paid in 1907 and 1908.

Tuesday, Feb. 28.

Evidence for the Corporation was continued to-day.

Mr. *Charles Hunt* said he concurred generally with the evidence given by Mr. Herring.

In Cross-examination by Mr. MURRAY, witness was asked his opinion of the evidence given to the effect that Parliament would have allowed only 7½ per cent. on the capital paid up in cash and 5 per cent. upon an additional sum representing £33,000—the capital expended out of profit. This, he said, was a matter which admitted of more than one view. It was very difficult to say exactly what Parliament would do under circumstances the like of which had never been before them. He concurred with Mr. Herring in this—that Parliament was not likely to give 10 per cent. on capital upon which 7½ per cent. had been paid for so many years. He could not refer to any precedent in Parliament which would have worked out in terms of Mr. Herring's views; but there was certainly no precedent for the present circumstances. He was perfectly clear that Parliament would not increase the 7½ per cent. to 10 per cent.; but he was uncertain as to what would take place with regard to the 5 per cent. Taking the most favourable view for the Company, the 7½ per cent. would, he thought, be allowed by Parliament up to a certain point—7½ per cent. upon the capital, less the amount received for premiums. By capital, he meant not only that which had been subscribed in cash, but capital which had been derived from reserve. He took this view because, although the dividend was limited to 7½ per cent. just prior to 1866, 2½ per cent. was paid to the shareholders; making 10 per cent. upon the then capital. When they doubled the capital in 1866, they informed the shareholders that the 2½ per cent. would be discontinued, and 7½ per cent. was allowed on the total. This was equivalent to 10 per cent. on one half and 5 per cent. on the other half. In his view, Parliament would not give 7½ per cent. upon premiums subscribed by the shareholders in hard cash. He thought Parliament would take into account the value of the works as they stood to-day. If Parliament were perfectly satisfied that £100,000 had been expended, he took it that they would allow extra capital. If the Company had declined to sell to the Corporation, they would undoubtedly have been able to compete. But it would not be fair to either. The Company would have a better chance than the Corporation; but he would be sorry to see such competition. He did not know of the case of a company which had refused to sell continuing to exist. In the case of non-statutory companies, his experience had been that liquid assets had always been the subject of separate valuation, and taken over or not taken over, according to contract between buyer and seller.

The OVERSMAN: I cannot conceive that the Corporation want to get these assets for nothing.

In further cross-examination, witness said that, deducting £11,000 liquid assets, the valuation with which witness concurred was £68,400. This worked out at about £250 per million cubic feet of gas sold, which was undoubtedly a very low figure. He did not know whether it was the case that the Dunfermline price worked out at £157l. He had usually allowed 15 per cent. as a reasonable margin of safety to be put on for the working powers of a retort. He thought 9000 cubic feet of gas per retort would be a reasonable figure as the productive capacity of a retort in Kirkcaldy when working under the conditions which he saw. Looking to the class of coal, 10,000 feet would be a very good figure. In the Falkirk case, he believed his valuation was £38,000. It worked out at a little under half the amount awarded. In the Nantwich case, his valuation was £30,863; and the award worked out at over double his valuation. This was a very high award indeed. Counsel was very near it when he suggested that in the Yeovil case witness's valuation was £54,000 and the award £80,000. Witness pointed out that Counsel did not say what the other side wanted in the cases mentioned. In the Nantwich case, witness expressed the opinion that the result of the award would be that a rate-in-aid would be imperative in the future, or that the price of gas would be increased. His "dismal prophecy," he was glad to say, had not been verified. With the £2163 Nantwich had done well, had never had to make a rate-in-aid, and had not increased the price of gas. He thought the result had been the same in Falkirk. In Yeovil, the award worked out at over £2000. A normal charge all over for expenditure for repairs, renewals, and depreciation, exclusive of stores, was 5d. to 5½d. In regard to purification, it depended upon circumstances whether 0·5 square foot should be taken in order to estimate the efficient power of a purifying plant. This was not a usual figure. Sometimes 0·4 was taken. Witness asked 0·6 in this case. He was the author of a book on the construction of gas-works, in which he suggested 0·4 as a useful allowance under ordinary conditions. The conditions which were other than ordinary, and which led him to increase the allowance at Kirkcaldy, were the amount of carbonic acid in the gas.

Mr. *Herring*, recalled, said that, according to the monthly carbonizing books, up to Dec. 31, 1910, he found the number of retorts in use was entered as 80, and the ovens in use as 10. If the carbonizing book for 1910 was correct, the number of retorts and of ovens resulted in their only dealing with three units open and free. In the daily book, he found that, during the month of December, 1909, there were over a very large part of the month from 76 to 80 retorts in use.

Mr. MURRAY indicated that he would rather take the daily book.

By Mr. WOODALL: It simply meant that the carbonizing was slightly better in the one year than in the other.

Mr. *George Simpson*, Assessor for the burgh of Leith, stated, in reply to Mr. MACMILLAN, that the area occupied by the gas-works property measured 5548 yards. Between him and Mr. Marwick there was only a difference of 49 yards. All the buildings occupied by the gas-works he took as in a fair state of repair and as having been well maintained with one or two exceptions. On the whole, they were in a fair state of repair for provincial gas-works. They had grown in proportion to the demand for gas, and had been added to and altered from time to time. In arriving at his valuation of the gas-works buildings, he had taken them at a fair value as a going concern; and in most cases the prices he had given were those at which the buildings could be reconstructed. He had not allowed any sum for depreciation in fixing the value, nor had he added any sums for plans, superintendence, and other incidental charges. The 5548 yards at 12s. 3d. came to £3398 3s. From this he deducted feu duty of £1 7s. 8d. at 20 years' purchase and the casualties of £56 17s., making a deduction of £112 18s., and fixing the value of the land occupied by the gas-works at £3285 5s. His figure for the gasholder site across the School Wynd was 1513 yards, which, at 12s. 3d., made £926. The land at Pathhead he made out to be 3038 yards. His rate there was £1300 per acre, or 5s. 3d. or 5s. 4d. per yard, making £816 8s., reduced by feu duty deductions to £795 14s. 8d. Adding these figures, he arrived at £5010 15s. 2d. This was for land alone. The balance to make up the figures of £5973 17s. 10d., which he considered a fair valuation, was the value of a series of buildings—the boundary walls, open courtyards, &c. There was nothing special to differentiate the gasholder site across the School Wynd except that it had no frontage to the main street. As regarded the Pathhead premises, the area there was 3038 yards, 1461 yards of which was occupied by the gasholder and the balance of 1577 yards as garden ground. He had taken the rate of £1300 per acre for this ground; and he justified that with reference to certain transactions.

By Mr. WOODALL: The price paid by the Company for the land originally was £450 for the whole of the area.

In further cross-examination, witness said that the site value of the land which was the subject of the transfer was to be ascertained by the cost of the land less the value of the building. The Lockhart land was no doubt purchased by the Company in order that part of it might be occupied by the works; but he did not say that it was purchased by the Gas Company to occupy the whole by the works. If this were a Lands Clauses Act transfer, he would have included the 10 per cent. as an item. He had never had experience of a transfer under the Gas-Works Clauses Act of 1867.

In reply to the OVERSMAN, witness said he valued the land at 12s. 3d. per yard, while Mr. Marwick's value was £2 per yard. Land value in this part of Kirkcaldy had gone down very much; and his sheet anchor with regard to that was the Lockhart transaction.

Mr. *Daniel Macfie* said he had been furnished with a statement showing the number of meters in use and in store belonging to the Kirkcaldy Gas Company. At May 31, 1910, it showed a total of 9058 meters of various sizes and types, of which 6195 were wet meters in cast-iron cases; 820 were dry meters, mostly in cast-iron cases; and 2043 were slot meters—dry meters, in tinplate cases, with a small proportion of wet meter conversions. He surveyed 163 meters in all. Of these, 103 were wet, 52 were dry, and 8 were slots. So far as he could judge by external inspection, the wet meters were of various ages, from 15 to 50 years old. None had been bought within recent years. He found that meters bearing the date 1844 had been recently taken out. He saw three over 60 years old. He did not examine their condition. For their age they were wonderful. They would not comply with the Gas Act. Of the wet meters in stock at the works, not more than 120 would be capable of use or repair. Most of them were obsolete and not worth more than scrap. The dry meters that came under his notice all bore the official stamp. Only about one-third of the wet meters that he saw bore the official stamp. Of the meters he saw in use, two-thirds bore no stamp at all. Of course, these had been properly stamped in the first instance; but the stamps had been broken in repairing, and they had never been sent for re-stamping. He found that between Jan. 31, 1906, and May 31, 1910, as many as 2445 wet meters had the official stamp and seal broken for overhauling and testing. The wet meters that he inspected appeared to be in quite good condition. In a considerable number of cases the condition of the meters was such as to suggest need for overhaul. The demand for wet meters in Scotland had very much fallen off during the last 20 years. In that period the practice of scrapping and replacing them with drys had prevailed.

In cross-examination by Mr. MURRAY, witness said that the meters he examined in position were in an efficient condition. Stamped or unstamped they were all serviceable and efficient. He saw a test-holder there of the usual type. He had no actual proof that 27 per cent. of the total did not represent the whole meters lacking the Government stamp.

In reply to the OVERSMAN, witness said he knew there were corporations who made it their business when a meter was taken out and found not correct to have it officially stamped, either at their own office or at a distance. The Kirkcaldy Gas Company had not done this with these 2445 meters.

Mr. *R. C. Lockhart*, a linen manufacturer and a member of the Kirkcaldy Town Council, said, in answer to Mr. CLYDE, that the public in Kirkcaldy had not been satisfied with the quantity and quality of gas supplied. The population of Kirkcaldy was about 40,000; and 1d. on the rates brought in about £700. The rates just now were 4s. 4d. He detailed the criticisms which had been made of the Gas Company, and the proceedings which had led up to the proposed transfer.

In cross-examination by Mr. MURRAY, witness said he was the owner of property in School Wynd, and sold it to the Gas Company for £3000—what they considered a ridiculously high price. The valuation before the sale was £2020. In 1904 and 1905, prior to the valuation, the property stood in his books at between £1700 and £2000. There

had been a long-standing feeling in Kirkcaldy that the price of gas was too high; but to the best of his recollection he had never heard that, during his connection with the Town Council, mentioned in the Town Council prior to 1907. At practically every municipal election in Kirkcaldy the question of gas was raised. The complaint was about the quality and price; but, so far as he knew, no step was taken by the Kirkcaldy citizens to endeavour to effect a reduction in the price.

Bailie *James Wright*, of Kirkcaldy, agreed with the previous witness in his account of the state of feeling among the public. In cross-examination, he admitted that he had never made any written complaint either as to the quality or the price of gas.

Councillor *Ferguson*, of Kirkcaldy, the Chairman of the Municipal Lighting and Tramway Committee, examined by Mr. CLYDE, said that on May 15 last they completed the seventh year of their working. They then had 519 consumers of electricity, as compared with 201 in May, 1905—an increase of 158 per cent. in five years. These consumers took the equivalent of 258,000 8-candle power lamps. The increase in the consumption between the same dates was represented by an increase of 143 per cent. They had installed motors having a total of 933 H.P., as compared with 222 H.P. five years ago. At present, their working costs, excluding coal, were 0·325d. per unit, as against 0·415d. five years ago—a reduction of 25 per cent. The present price per unit was from 4½d., their maximum for lighting, to ¾d., their minimum for power. He should say that, so far as lighting went, they had taken a large business from the Gas Company; but he would not say the same with regard to power. Complaints against the quality of the gas had been rife in Kirkcaldy.

This closed the case for the Corporation.

The tribunal adjourned until Saturday next, when Counsel's speeches will be heard.

WELSBACH COMPANY'S SCHEME APPROVED.

The Great Hall at Winchester House, Old Broad Street, E.C., was filled with shareholders last Thursday morning, at the hour fixed for the holding of an extraordinary general meeting of the Welsbach Incandescent Gaslight Company, Limited, to consider the scheme provisionally arranged between the Company and the Deutsche Gasglühlicht Aktiengesellschaft (Auergesellschaft), of Berlin, for the promotion of a new Company in England to acquire the undertaking of the English Company. Full particulars of this scheme were set out in a circular previously distributed among the proprietors, and the main features of which were reproduced in last week's "JOURNAL" (p. 620).

Altogether the proceedings lasted nearly two hours; and, though absolute unanimity on all points was not shown by those present, the following resolutions had, at the end of this period, been duly passed: "(1) That the provisional agreement submitted to this meeting, dated Jan. 30, 1911, and made between the Deutsche Gasglühlicht Aktiengesellschaft (Auergesellschaft), of No. 12, Rotherstrasse, Berlin, of the one part, and this Company of the other part, being an agreement as to the promotion of a new company in England, and the proposed sale to such Company of the undertaking and assets of this Company, upon the terms therein mentioned, be, and the same is hereby, ratified and approved. (2) (*a*) That it is desirable to reconstruct this Company, and accordingly that this Company be wound up voluntarily, and that Henry Edward Spinney, of Nos. 344-354, Gray's Inn Road, in the County of London, be, and he is hereby, appointed Liquidator for the purpose of such winding-up. (*b*) That the said Liquidator be, and he is hereby, authorized to concur in the formation of a new Company on the lines mentioned in the said agreement of Jan. 30, 1911, and pursuant to section 192 of the Companies (Consolidation) Act, 1908, to sell to the Company to be formed the undertaking of this Company as a going concern and all the assets thereof on the terms in such agreement mentioned, with such modifications as may be found necessary, and to do all such things, and to enter into all such agreements and assurances, as may be necessary or proper for such purpose, and also to distribute in specie the debenture stock and shares of the purchasing Company forming, or to form, part of the purchase price for the purpose of giving effect to the provisional agreement submitted to the meeting, dated Feb. 21, 1911, and made between Walter Warner Wright on behalf of the holders of the preference shares of this Company held by the members thereof of the one part, and this Company of the other part, being an agreement by way of modification of the rights and privileges attached to such preference shares. (3) That the said provisional agreement be, and the same is hereby, ratified and approved." Resolution No. 2 will be submitted as a special resolution to a second extraordinary general meeting which will be subsequently convened.

A separate meeting of preference shareholders was afterwards held, when the following resolution was passed—"That the provisional agreement submitted to the meeting, dated Feb. 21, 1911, and made between Walter Warner Wright on behalf of the holders of the preference shares of the Company held by members thereof of the one part, and the Company of the other part, being an agreement by way of modification of the rights and privileges attached to such preference shares, be, and the same is, hereby ratified and approved."

The chair was taken by Lord Weardale, who went to great trouble to lay before the shareholders in the clearest possible manner the scheme that was put forward for their approval. Before he did this, some time was necessarily occupied in the reading, by the Solicitor to the Company, of the agreements to which the resolutions referred. The Chairman said it would be within the recollection of proprietors that at the meeting last May a resolution was passed to the effect that the consideration of a scheme for the reduction of the capital should stand adjourned until February, 1911. Now, however, the Board had convened the present meeting to consider a proposal to sell the undertaking as a going concern, instead of proceeding with a scheme for the re-organization of the capital. The hopes expressed at last year's meeting had not been fulfilled by the earnings of the business for the financial year to date; for sales had continued to show a decline, both at home and abroad. In the incandescent business, the season's trade, generally speaking, opened out during the last weeks of August and the first weeks in September; and early last September a circular was issued by a shareholder which did great harm to the business of the Company. The same shareholder also addressed a later letter to the Press; and both these communications were used against the Company by their competitors. When negotiations were therefore opened by the German Company, the Board considered it was their duty to consider the proposals put before them. Whatever course might now be decided upon, it was a satisfaction to the Board, particularly after the last few years of strenuous competition, to be able to come and point out that the assets with which the shareholders entrusted them in 1903 still existed. The issue of the Board's circular last month naturally brought forth criticism and comments from some of the shareholders; the idea seeming to be that the purely preference shareholder was unfairly treated under the scheme to the advantage of the ordinary shareholder. Well, the present scheme would provide 11s. 4d. per share for the preference, and about 2s. 8d. for the ordinary shareholders. The re-organization of the capital suggested last year provided for a capital of £500,000 in common stock, on the basis of 15s. per share going to the preference shareholders, and 1s. 4d. per share to the ordinary. He thought gentlemen who criticized the present proposals took a narrow view of the two schemes. While the scheme of last year simply put forth a hope for the future as regarded both classes of shares, the present proposal gave the preference shareholder something really tangible—namely, 30 per cent. of the amount to be received in actual cash, and the remaining 70 per cent. in 4½ per cent. debentures of the new Company, guaranteed by the German Company both as to principal and interest. More than this, a sinking fund of £8000 a year (commencing in 1913) would be provided as an additional safeguard. He put it to the shareholders that an actual payment in cash of £100,000, and an absolute security of this character, was a very different thing from the hope for the future set out in the scheme put forward by the Board in May last. The preference shareholders might ask why they should forego any of their rights in favour of the ordinary shareholders. The answer was that, on account of the voting power of the ordinary shareholders, the undertaking could not be sold as a going concern without their consent. The German Company was a strong and powerful concern, with a capital of 19,800,000 marks (say, £990,000), divided into ordinary and 5 per cent. preference shares. They had also a reserve fund of 5,212,000 marks (£260,600), the dividend on the preference shares had been paid throughout; and dividends on the ordinary shares were: in 1906, 22 per cent.; 1907, 22 per cent.; 1908, 35 per cent.; 1909, 50 per cent.; and 1910, 50 per cent. The last quotation on the Berlin Stock Exchange of the ordinary shares was 670 per cent., and of the preference shares 104·7 per cent. The Company were the manufacturers of the Osram lamps in Germany, and were further considerably interested in the Osram lamp works at Hammersmith. The Welsbach Board had been attacked because they had been unable to do what the German Company, under a protective system, had been able to accomplish. Up to 1907, the German Company brought large profits into the Welsbach Company through the dividends of the Austrian Company, whose customers they were for lighting fluid. In that year, however, the fluid agreement with the German Company expired; and the latter Company then took steps to commence manufacturing it for themselves. Consequently, the Austrian Company, in order to find customers for their output, had had to force their way into the open German market; and the effect of this would be increasingly felt. The Board thought they were justified, therefore, in assuming that the bulk of the German Company's recent dividends had been due to the success of the Osram lamp, and not to the incandescent gas lighting trade.

As representing the Shareholders' Committee, Mr. C. Lock emphatically supported the proposals before the meeting. Mr. L. I. Cadell said that he declined to be made the scapegoat for the loss of profits of the Welsbach Company. It was true that he sent out a circular; but it was followed by a rise of 50 per cent. in the price of the shares, and they had not had any serious set-back since. It seemed to him, however, that the proposal now put forward was the best the shareholders were likely to get; and therefore he did not propose to follow up his opposition any further. In fact, from a financial point of view, they were forced to accept the scheme. The next speaker—Mr. Wyatt—opposed the resolutions; remarking that for years he had complained of the management of the Company. But the audience showed little patience in listening to him; and after a while, a resolution was put and carried—"That he be no further heard." Mr. A. Akers pointed out that the German Company would hold 62 per cent. of the entire capital of the new Company, and the Welsbach people only 38 per cent.; and therefore it might conceivably be to the advantage of the German Company to run the business in such a way as to make large profits for the German shareholders, and let things here go to pieces. He still thought there was room for procedure by reduction of capital, which might be better for the shareholders than this scheme. The Chairman remarked that the whole object of the present arrangement was to get rid of competition. They would have the right of appointing two Directors of the new Company—probably out of five; but this had not been settled yet. The Board felt that the German Company, having a substantial interest in the English Company, would have every reason to try and make it a success. Mr. H. Green, who said he was an original shareholder, remarked that, unless the shareholders supported this resolution, they would bitterly regret it—simply on the score of mismanagement. Amid laughter, he added: "The Germans can save us."

Before separating, votes of thanks were accorded to the Chairman and those who had supported him, as well as to the Shareholders' Committee for the work they had done.

Readers may remember that the Wandsworth and Putney Gas Company bring their coal from Newcastle in their own collier the *Wandle*. In the course of the proceedings at the recent employees' annual dinner, noticed elsewhere, the Company's Engineer (Mr. H. O. Carr) stated that the vessel made last year seventy trips to the North and back, which was a "record" for coastwise colliers. He said the Company not only had a wonderful boat, but she was unloaded in almost record time for colliers in the Thames. He thought all would agree when he said they had a most excellent Captain on board, and also an excellent crew. In fact, the Directors had been so pleased with the Captain that they gave him a cheque.

PRESTON GAS COMPANY'S PROVISIONAL ORDER.

Board of Trade Inquiry.

It has already been mentioned in the "JOURNAL" that the Preston Gas Company are applying to the Board of Trade for a Provisional Order to authorize them to reduce the illuminating power of their gas from 18 to 14 candles. The application is being opposed by the Preston Corporation, the Urban District Council of Walton-le-Dale, the Preston Rural District Council, and the United Operative Plumbers' Association of Great Britain and Ireland. The matter was inquired into last week by the Hon. T. H. W. Pelham, one of the Assistant-Secretaries of the Board, at their office in London. At the outset of the proceedings, which opened on Wednesday, objection was taken by the representatives of the two District Councils to the power of the Board to deal with the application; but Mr. Pelham declined to give a decision upon the point. Mr. Honoratus Lloyd, K.C., then opened the case for the Company, and called Mr. Samuel Tagg, the Engineer and Manager. He was followed by Mr. Corbet Woodall, at the close of whose evidence the inquiry was adjourned till Friday. On the resumption of the proceedings, the first witness was Mr. J. Ferguson Bell, of Derby; and after him came Mr. Charles Carpenter, the Chairman of the South Metropolitan Gas Company. This was the case for the applicants. Mr. J. G. Talbot, K.C., then opened that of the Corporation, who, he said, opposed any reduction in the illuminating power of the gas. He called Mr. James Carter, the Borough Treasurer, and Mr. Thomas Cookson, the Borough Surveyor and Engineer, of Preston, Mr. William Newbigging, and Mr. Isaac Carr. The inquiry was then adjourned till the following day, when Mr. E. H. Stevenson and Mr. W. S. Woodcock gave evidence on behalf of the Urban and Rural District Councils; and Mr. J. G. Newbigging was called for the Plumbers' Association. Mr. Knox and Mr. Honoratus Lloyd having addressed Mr. Pelham, the inquiry was concluded. A fuller report of the proceedings is unavoidably held over till next week.

PUBLIC LIGHTING OF KENSINGTON.

Last Tuesday, the Works Committee of the Council of the Royal Borough of Kensington, after several adjournments to enable the Borough Treasurer to compare the two schemes of the Borough Lighting Engineer and the Gaslight and Coke Company, submitted what was a fairly conclusive and instructive report upon the question of the public lighting of the borough; and, by sitting to a late hour, they debated and decided the question of who is to take charge of the lighting and maintenance of the gas-lamps. The question, it will be seen, was not one of gas *versus* electricity for lighting the thoroughfares, but whether the Borough Council or the Gas Company should shape the policy of the public lighting in the matter of the illuminating power of the lamps, the type of burner and lantern to be used, and the consumption of gas per burner, for the next ten years; also whether the existing old lanterns should be converted and kept in use by the Council, or the Gas Company be allowed to "scrap" them, and supply, and charge in their annual lighting bill for, new and up-to-date copper lanterns suitable for taking the new inverted burners. There was a very full attendance of members, and the matter was discussed with great vigour until nearly 11 p.m.

The Works Committee, in a report dated the 21st ult., stated that they had further considered the report submitted by them on the 6th of December last on the subject of the offer made by the Gaslight and Coke Company to take over the street lighting by gas throughout the borough, and had had before them a further report by the Street Lighting Sub-Committee on the reference. The Sub-Committee's report contained the offer made by the Gas Company, as set forth in a letter addressed by the General Manager (Mr. D. Milne Watson) to the Town Clerk (Mr. W. Chambers Leete), on Oct. 16, 1910, furnishing the details of a scheme for improving the public lighting. Briefly, it was to substitute for the 828 one-burner 60-candle power lamps now in use in the thoroughfares specified in a schedule to the letter, 348 two-burner (160-candle) lamps and 480 three-burner (240-candle) lamps. Further, it was suggested that 46 five-burner (400-candle) lamps should be substituted for the 24 two-burner (120-candle) and 22 three-burner (180-candle) lamps at present in use on refuges, the 15 recently erected three-burner inverted lamps on refuges being retained as at present; and that new one-burner (80-candle) inverted lamps should be substituted for the remaining 3664 one-burner (60-candle) upright lamps, and eight flat-flame (15-candle) lamps now in use. It was stated that the total effect of these proposals would be to increase the light in the streets from 280,000 to over 480,000 candle power. Mr. Milne Watson made the following remarks upon the scheme.

This vast improvement the Company are prepared to effect for the Council on terms that will entail no initial expenditure, and, I estimate, little, if any, increased annual expenditure, in comparison with the average cost of the past few years. If granted a contract for ten years in respect of all the streets in the borough now lighted by gas (with powers to terminate at earlier dates specified later herein), the Company would be prepared—

(*a*) To supply and fix at their own cost new circular all-copper inverted-burner lanterns of similar pattern to those recently fixed in the City of Westminster, in substitution for the existing lanterns in the borough; the former to become the property of the Council at the conclusion of the contract, the latter to become the property of the Company as and when removed.

(*b*) To supply gas for 3940 hours per annum to the lamps, and to light, extinguish, clean, maintain in first-rate lighting order, repair, and paint annually with two coats, the lamps at the following inclusive fixed prices per annum: Per 80 c.p. lamp, £2 12s. 6d.; per 160 c.p. lamp, £4; per 240 c.p. lamp, £5 10s.; per 400 c.p. lamp, £7 10s.

(*c*) To take over and, subject to good behaviour and service, continue to employ, the Council's workmen, who would have the opportunity of becoming co-partners in the Company.

The annual cost under this proposal would be: 3672 lamps at £2 12s. 6d., £9639; 348 lamps at £4, £1392; 480 lamps at £5 10s., £2640; and 46 lamps at £7 10s., £345—total, £14,016. The Council to have the power to terminate the contract at the end of either five or seven years upon payment of £8500 or £5000 respectively, but to compensate the Company for the loss of a proportion of the capital expenditure, which, under the terms quoted, has been spread over the full period of the contract.

Mr. Milne Watson's letter was followed on the 30th of December by a memorandum drawn up for the information of the Sub-Committee on the Company's scheme, and offering explanatory observations and remarks upon the report of the Sub-Committee in reference to it.

The Borough Treasurer (Mr. E. A. Coombs) a few weeks later submitted the comparative statements in regard to the Company's offer, from which the following particulars are extracted:—

A.—Estimated Cost per Annum to the Council of Carrying Out a Similar Scheme to that Proposed by the Gas Company.

Gas supply to 4546 lamps = 6038 burners, consuming 3½ cubic feet of gas per hour for 3940 hours, at 2s. 2d. per 1000 cubic feet	£9020	5	4
Gas supply to 15 refuge lamps and 20 new lamps	126	19	9
Total for gas	£9147	5	1
Stores and materials (including mantles)	816	4	8
Wages of workmen (three years' average)	3516	9	10
Removing and refixing lamps (three years' average)	10	10	7
Establishment charges, supervision, &c. (estimated average for next ten years)	500	0	0
Capital outlay, 4546 solid all-copper lanterns and fittings. Loan of £9220 at 3¾ per cent. repayable in ten years. Average annual charge for repayment of, and interest on, loan	1112	3	3

B.—Estimated Cost per Annum to Council if Contract were Entered Into with the Gas Company for a Period of Ten Years.

Gas Company's annual charge for supplying and fixing 4546 new lanterns, supplying gas and lighting, extinguishing, cleaning, maintaining, repairing, and painting the lamps	£14,016	0	0
New lamp-columns, lanterns, and fittings (20 at £6)	120	0	0
Erecting and fitting do.	100	0	0
Maintenance and gas supply, 20 new lamps, and 15 refuge lamps	163	15	0
Removing and refixing lamps (*per contra*)	10	10	7
Establishment charges, supervision, &c.	500	0	0
Total of A	£15,142	13	6
,, B	14,937	7	11
Balance in favour of the Gas Company	£205	5	7

A copy of this statement was forwarded to the Gas Company; and subsequently the Sub-Committee had a long interview with the Controller of the Company's Gas Sales Department (Mr. F. W. Goodenough), in order that he might lay before them the Company's criticisms thereon, with such further particulars and information as the Company might wish to furnish. The items in the statement which were particularly criticized by the Company's representative were the sum of £9147 5s. 1d. provided for the supply of gas, the amount of capital outlay (£9220) for the purchase of lanterns, fittings, &c., and the sum of £500 provided for establishment charges, &c., in the event of the Company's offer being accepted. Explanations were offered; and these were dealt with by the Sub-Committee in their report.

The Lighting Engineer (Mr. Philip Monson) submitted to the Sub-Committee a report embodying a scheme for effecting improvements in the lighting of the borough, giving a schedule of the thoroughfares proposed to be dealt with, and the estimated cost. The principal items in his estimate were as follows:—

Gas supply to 4561 lamps (3799 one-burner, 560 two-burner, and 202 three-burner) = 5525 burners, consuming 3½ cubic feet of gas per hour for 3940 hours = 76,189,750 cubic feet, at 2s. 2d. per 1000 cubic feet	£8,253	17	11
Wages of workmen (£3516 9s. 10d.), stores and materials, including mantles (£816 4s. 8d.), establishment charges (£500), &c.	4,883	5	2
	£13,137	3	1
Capital outlay for new lanterns and adapting present lanterns for inverted burners, provided for by loan of £3700, at 3¾ per cent. for five years—average annual charge for repayment of, and interest on, loan	823	5	0
Annual cost for first five years	£13,960	8	1
Annual cost subsequently	£13,137	3	1

The concluding paragraph of Mr. Monson's report was as follows:—

With the Gas Company's scheme, the cost according to the Borough Treasurer's statement would be £14,937 per annum, and with the scheme I recommend, the estimated cost for the first five years would be £13,960 per annum, and £13,137 per annum for the following years—thus showing a considerable saving in the ten years, even if the price of gas remains as at present. I think there is every possibility of a reduction in the price of gas, as carburetted water gas is very quickly made; and now that the standard illuminating power of the gas has been reduced to 14 candles, the gas companies can make 11,000 or 12,000 cubic feet of gas from each ton of coal, instead of 9500 cubic feet as they did formerly, when the gas was of higher illuminating power.

The present annual cost of street lighting is £14,370; and the totals of the other schemes are, as already stated, £15,143, £14,937, £13,960, and £13,137. After giving the subject the fullest consideration, the Sub-Committee came to the conclusion that no sufficient reason had been shown to justify the Council in abandoning the system under which they had carried out their own street lighting for upwards of thirty years. They accordingly recommended—

(*a*) That the Gaslight and Coke Company be informed that the Council do not see their way to accept the offer made by them for the taking over of the street lighting by gas throughout the borough.

(*b*) That, as an alternative to the acceptance of the Gas Company's offer, the scheme for improving the street lighting of the borough as embodied in the Lighting Engineer's report be adopted, and that provision be made in the Council's estimates for the ensuing financial year for the necessary amount required during that period to give effect to the same.

The Works Committee had before them a further communication from the General Manager of the Gas Company, furnishing replies to questions put to Mr. Goodenough on the occasion of his interview with the Sub-Committee. They related, first, to the conditions upon which the Company would receive into their service the employees of the Council in the event of a contract for the lighting of the borough being entered into; secondly, to the question of having a 3½ cubic feet burner instead of the 4 cubic feet one recommended; and, thirdly, to the subject of converting the existing lamps. These matters were fully dealt with by Mr. Milne Watson, who pointed out that the change of burner would reduce the cost from £14,016 to £13,261 15s.—a difference of £754 15s. per annum. The Committee said they had considered the offers of the Company relating to the burners and lamps, and, looking to the completeness of the report of the Sub-Committee, they did not think it necessary to enter into any further details. They concurred in the views expressed by the Sub-Committee, and submitted their recommendations to the Council.

The Chairman of the Works Committee having moved the adoption of the report,

Mr. H. D. Ellis rose to propose, as an amendment, that the report be referred back for further consideration.

Mr. Foster, however, called attention to the fact that Mr. Ellis was a shareholder in the Gaslight and Coke Company, and asked whether the councillor was not debarred by the Standing Orders from taking part in the debate.

Mr. Ellis said he had a small holding in the Company, as the result of the recent absorption by them of another gas undertaking in which he had a small interest. He was quite willing to put himself in the hands of the Council and abide by the Mayor's ruling.

The Mayor (Alderman the Hon. Sir W. Phillimore, Bart.) informed Mr. Ellis that, according to the Standing Order, he could take part in the debate, but could not vote.

Mr. Ellis then proceeded to move his amendment.

The Mayor, however, informed him that, as he was unable to vote, he could not "move," and that some other member might move the reference of the report back to the Committee. The Councillor could speak to it.

This having been done,

Mr. Ellis criticized the report and the Borough Treasurer's comparative statement. He remarked that the Treasurer was not a gas expert, or the Council would not need the services of a Lighting Engineer. Reference had been made to the borough of Kensington being a "pioneer body." If this was correct, he trusted they would act up to this description in the matter of the lighting of the borough; for it was notorious that the streets were in a backward state from a lighting point of view. He trusted that in this question of lighting the public streets they would not become too conservative and stagnate. In his opinion, the Lighting Committee were only "tinkering" with the question by attempting to "convert" the existing lamps to the use of inverted burners. It might be cheap, but it would be "cheap and nasty." The speaker then criticized in detail the Lighting Committee's report, especially one portion of it, which related to the purchase of new lanterns by the Council. He said that, from his experience in the organization and direction of the Gas Company with which he was concerned (not the Gaslight and Coke Company), he had no hesitation in saying that it could not be done at the price stated.

Alderman Gates spoke in favour of referring the report back. He said it was both disingenuous and lengthy, and the return prepared, though showing a saving of £205 per annum in favour of the Gas Company, was not comparable, as the Lighting Committee were quoting for an inverted burner to consume 3½ cubic feet of gas per hour, while the Gas Company based their figures on one consuming more than 4 cubic feet per hour. The correct figure of the Gas Company should be £13,261 5s., not the £14,016 given in the comparative table. This would show a difference of £754 15s. between the two items; while on "capital outlay," the Gas Company would provide best circular pattern all-copper lamps that would last twenty years, with new cocks, governors, and stand pipes—in fact, everything "brand-new"—whereas the Lighting Committee's scheme gave none of these things. The speaker maintained that the saving, instead of being £205, would be £1000 per annum; equalling, on the term of years of the proposed contract, a capital sum of £10,000 saved by the borough. He was against a paltry scheme of conversion. They were told the conversion system had been tried and found effectual. Where had it been tried? On six lanterns only. He had inspected the lamps in question, and found the glass did not stand for two weeks. Every pane was broken, and had to be replaced; and they were continuously breaking. He ridiculed the putting down of £500 for establishment charges. The neighbouring boroughs of Chelsea and Paddington, and also the City of Westminster, each of which touched their borders, had handed over their public lighting to the Gas Company, all on very advantageous terms to themselves—viz., the City of Westminster for five years, the borough of Chelsea for seven years, and the adjoining borough of Paddington for ten years; while the great borough of Lambeth and the boroughs of Bethnal Green, Stoke Newington, Hackney, and others, had done the same.

Ten o'clock—the time for taking unopposed business only—having been reached, it was resolved that the debate should be continued.

Alderman Gates then proceeded with his remarks, stating that if the Lighting Committee persisted in their report, it would be a proof that they were stagnant; and he entreated them not to be a stagnant borough. He reminded the Council that they had a duty to discharge in regard to the lighting of the borough, which compared very unfavourably in this respect with that of the surrounding boroughs.

Mr. Foster supported the Committee's recommendations. He stated that the lamps with which they had experimented had been a great success; and he asked if it would be wise of them, in view of scientific advance in electricity and gas-burners, to tie their hands for five years. In three years' time there might be a considerable advance in both directions. If the scheme as outlined by the Lighting Committee did not succeed, in two years they could approach the Gas Company.

In the course of some remarks by the Mayor, he stated, with regard to the £500 for establishment charges, that if the Gas Company's scheme were to go through, the Council proposed to appoint two Lighting Inspectors, each at £250 per annum.

The Council then voted on the amendment—8 being for and 33 against it. The report was accordingly adopted; and the result is that a very generous offer to light the borough by the Gas Company was rejected in favour of the Council's own scheme.

COVENTRY AND LIME PURIFICATION.

The Coventry City Council have sanctioned the Gas Committee's recommendation [*ante*, p. 621] that £14,000 be spent on the provision of the necessary purifiers, connections, &c., required for a scheme for the removal of sulphur compounds from the gas by lime purification.

When the proposal was under discussion, Alderman Batchelor, the Chairman of the Gas Committee, reminded the Council that, at the time the plans for the new gas-works were presented, the Council were asked to allow the Committee to do away with lime purification. This application was based on the advice of Sir George Livesey, and also on the fact that Parliament had discussed the matter and had decided to dispense with compulsory lime purification in the case of certain undertakings. At that time, it was agreed that the proportion of sulphur would not rise to more than 35 or 40 grains per 100 cubic feet with oxide purification; but the facts now proved differently. Complaints had been made from time to time by the Watch Committee—and very properly so. There was no doubt that the excess of sulphur in the gas had been a nuisance. The Committee had tried their best in the past to reduce the quantity of sulphur, and at one period they thought they would succeed; but finally they decided to seek expert advice. Dr. Harold G. Colman was engaged, and had made an exhaustive examination of the works and of their methods of making gas; and he had given them his opinion. The Committee hoped that the Council would allow them to revert to lime purification, which, they were assured, was the only effective way of abolishing the nuisance. The Committee were desirous of paying the cost of the purifiers, &c., out of revenue. It was understood that the undertaking was fairly heavily capitalized; and if the course suggested were adopted, the department would be in a position to wipe off the expenditure quickly.

Mr. M'Gouran said they were told when they discontinued the lime purification that they would be saving about £4000. How was it that the present scheme was going to cost £14,000? Mr. Hill wanted to know if the original plant for lime purification at the old works was to be used. Mr. Halliwell considered that the report of the Committee was disquieting. It seemed they were still groping in the dark in this matter to find out what was right and what was wrong. He regarded it as strange that the Committee, during ten years, had been unable to form some opinion as to what was the right course to pursue. Mr. Poole agreed that the report was in some measure a confession of failure. They had always prided themselves on their new gas-works being up to date; but it looked to him as though they had been in somewhat of a hurry to adopt methods before those methods had been proved to be absolutely successful. He hoped that by the altered process they would get better lighting and cleaner gas, which would enable them to keep the fittings in something like decent order. Alderman West, a former Chairman of the Electric Light Committee, remarked that one of the arguments used by the experts when they were asked to consent to the gas being purified by oxide of iron was that any sulphur compounds that might be given off would be neutralized by the lime in the ceilings and walls of the rooms. They now knew that in practice this was a long way from the truth. Speaking as a member of the public, he was delighted to think that they would in the future have gas that would not half poison them.

Alderman Batchelor, in reply, said that the saving referred to by Mr. M'Gouran was nothing like £4000; but there was a saving. The old purifiers were practically worn out. With lime purification, they would certainly have much cleaner and better gas.

The Council then approved the Committee's recommendation.

Leatherhead and District Water Company.—The revenue of this Company for the six months ended Dec. 31 last amounted to £4694, and the working expenses to £2181; leaving a profit of £2513. At the recent half-yearly meeting, the Directors recommended the payment, out of the £2853 available for distribution, of dividends at the rates of 10 and 7 per cent. per annum, after which there would be a balance of £802 to be carried forward. There were 51 new services put on in the half year, making the total number 3542; increasing the water-rental from £4281 to £4445. The report was adopted.

Progress of Gas at Southend.—In moving the adoption of the Directors' report at the meeting of the Southend Gas Company last Tuesday, the Chairman (Mr. C. Frank Woosnam) directed the attention of the shareholders to a few items which he said he was sure would be of interest to them. In the first place, there had been a very satisfactory increase in the quantity of gas sold in the six months ended Dec. 31—4·16 per cent.—totalling up to nearly 8 millions, and making a record quantity (195 million cubic feet) disposed of in one half year. They had added 264 consumers to the list, making 13,718 on the books, and had 9359 gas cookers and 714 fires out in the district; so that more than 10,000 householders in the borough used gas for heating purposes. Some interesting figures had been handed to him by the Secretary (Mr. James T. Randall), showing the progress of the concern during the past nine years. In 1901, the gas sold was 149,670,000 cubic feet, the consumers numbered 4226, and the capital charge per 1000 cubic feet was £1 5s. 3d. In 1910, they sold 356,916,000 cubic feet, the consumers had increased to 13,718, and the capital expenditure was brought down to £1 2s. 1d. per 1000 feet.

AUSTRALIAN GASLIGHT COMPANY.

The Half-Yearly Meeting of this Company was held in Sydney on the 30th of January—Mr. G. J. COHEN, the Chairman of the Company, presiding.

The SECRETARY (Mr. R. J. Lukey) having read the advertisement convening the meeting, the report of the Directors for the six months ended Dec. 31 last was taken as read. It showed that the profits amounted to £76,661; and the Directors recommended the payment of a dividend for the six months of 9s. per share, free of income-tax. This would absorb £63,749, and leave £12,912 to carry forward. The Directors mentioned that the Engineer (Mr. T. J. Bush, M.Inst.C.E.), who was in London on leave, was rendering valuable service in connection with the new plant required for the Mortlake works, which includes an installation of Glover-West vertical retorts—the first of its kind to be erected in Australia. They also expressed their regret at having to report the occurrence of a strike among the Company's workmen on the 12th of January, causing much inconvenience to their customers and the public generally. Fortunately, it was of short duration; the men returning to work the following day.

The CHAIRMAN, in moving the adoption of the report, said he regretted that the pleasure he anticipated in meeting the shareholders had been greatly marred owing to the trouble the Company had had with their workmen, who, with scarcely any warning, by their action, plunged the city and suburbs into darkness—and this in the face of an agreement providing for the settlement of all disputes, which was disregarded by the men, who made a direct demand for the reinstatement of the workmen concerned. The Company were threatened that if a certain course were not taken the men would throw down their tools. The Company refused; and a strike was declared. The entire Press and public were evidently at one in sympathy with the Company, and against the action of the men. The first step the Board could have taken would have been to insist that the law should at once be set in motion against the strike leaders, especially as the supply of gas—a product of public utility—was interfered with. But it was felt that such a step would mean considerable delay. The public, in the meantime, would have been the greatest sufferers. Fortunately, Mr. Beeby, in whose Department the matter lay, and Mr. Carmichael, to each of whom the Company and the public were indebted for their genuine efforts to smooth matters over, seeing the gravity of the position from the point of view of the public, freely conferred with both sides in order to bring about a truce, and prevent the works being closed altogether. These endeavours eventuated in a proposal for the conference. This was a procedure which, under ordinary circumstances and for an ordinary company, was not acceptable, and could not be agreed to by any board. The tribunal suggested by the Minister and Mr. Carmichael—made up of an equal number of members of the Board and employees of the Company, with a man of the calibre of Mr. J. C. Watson as Chairman and Judge—seemed to the Board the only possible way of getting at a decision which the men could not cavil at, and a ready means of obtaining an outside judgment on all the points involved. But what weighed with the Board all through was that they were something more than mere shareholders or directors of an ordinary company. Gas was now so much used in manufacture and for domestic purposes as to be almost as essential as air and water; and they deemed it that their first duty was to their close upon 100,000 customers who were dependent upon an uninterrupted use of gas for their everyday work, and to the public generally, and that they should take every step—to concede almost to the utmost limits of concession—rather than that the city be plunged in darkness, and a prolonged strike and strife entered upon, the effects of which could only be great suffering and loss to the whole of the community. The deliberations of the Conference had come to an end; and the decision of the Chairman (Mr. Watson) on the evidence submitted was awaited. The charge recently made against the Company in one of the daily papers in not having sufficient gasholder capacity to meet such emergencies showed the ignorance of the writer in posing as an authority on gas matters, as in works of the magnitude of the Australian Gaslight Company 24 hours' stock of gas was, in the opinion of most eminent engineers in England and the Continent of Europe, all that any company could be expected to provide. In connection with this matter, he referred to the loyal response made by the whole of the clerical staff to the appeal for volunteers to maintain the furnaces during the period of the strike. These services were so effective that when the men returned to work they were able to start straight away to make gas; thus minimizing to a great extent the inconvenience to the general public. He further added that, by keeping the fires going, the Company's property had been protected from serious damage, which otherwise would have resulted. He therefore personally, and on behalf of the Board, tendered to these officials their hearty appreciation of the loyal and effective services rendered by them at a critical time. The Board intended to reward them for the assistance given. With reference to the report and balance-sheet, nothing could, he thought, be more satisfactory than the results indicated. The increase reported over the previous half year had been fully maintained; there being over 8 per cent. more gas sold than during the corresponding period, notwithstanding that in that half year the extra demand for gas in consequence of the coal strike had begun to show itself towards the end of the period. The new extensions foreshadowed in his last address to meet the increased demand for gas were being proceeded with. It had been found quite impossible, however, for the whole of the necessary machinery to reach Sydney in time for erection this year; but sufficient additional plant would be in working order to meet the ensuing winter's requirements, which they anticipated would be exceedingly heavy. The future extensions at their Mortlake works would include the first section of what would ultimately be a complete installation of the "Glover-West" system of vertical retorts—the first of its kind to be introduced in Australia. The Company also intended introducing mechanical coal and coke handling plant; electricity being the motive power. When all these several extensions were carried out, the Company would, without doubt, have the most complete machinery for the manufacture of gas in the Southern Hemisphere. It was fortunate for them that the health of their Engineer (Mr. T. J. Bush) had improved so much as to enable him to give his advice, in London, in connection with the new plant, as his intimate knowledge of the works and their requirements were of great importance. During his absence, Mr. A. Wilson, the Chief Assistant-Engineer in charge of the works, had carried out his duties most satisfactorily. The Company's coal requirements having been secured for a lengthened period, on favourable terms, the Directors were enabled to announce a reduction, from the 1st January, of 3d. per 1000 cubic feet of gas for private consumers, and of 5s. per lamp per annum for the public lights. Although to the general public these reductions appeared small, yet they represented a reduction in revenue of about £30,000 per annum. A further reduction in revenue had been caused by the displacement of gas by electricity in the municipalities of Newtown and Annandale this year; and other councils had also intimated their intention of so doing next year. Owing to the policy of the Directors in supplying the public lights as near to cost as possible, the net profits of the Company would not be affected by the change. The energy displayed of late by municipal councils in installing electricity in the suburbs was not, he considered, justified by results. Light for light, gas was not only far superior as regards illumination, but cheaper. A striking instance of this was being demonstrated in front of the Head Office of the Commercial Banking Company of Sydney, in George Street, where two high-pressure gas-lamps with inverted burners had been fixed in the midst of the City's best display of electric arc lights, with most excellent results. The illumination from these lamps was far superior and more pleasing to the eye, besides costing considerably less. The Gas Company did not ask for favours, but only for fair consideration, which was not extended to them in these matters. Then, again, from an æsthetic point of view, the residents in the suburbs should not submit to the replacing of the Company's ornate pillars, which had been supplied at great cost, by bare wooden posts and unsightly wires, to the detriment of the neighbourhood in which they were placed. The Board regretted that the Government had been compelled to resume the Company's land at Petersham, in connection with their railway extension from Flemington to Darling Harbour, as the site was intended for the erection later of a gasholder, and was an ideal one for the purpose. The Company would now be forced to adopt other arrangements to meet the ever-increasing requirements of the district. By the "Workmen's Compensation Act, 1910," which came into force on Jan. 1, the interests of the employees were well guarded; and it behoved companies such as theirs to make provision, either by insurance or the creation of special funds, to meet the liabilities contemplated by this measure. As far as the Company were concerned, they had for some years past been building up a fund to meet claims for accidents, the contributions to which would now be materially increased each half year. The operations of the Company during the past half year were very encouraging. The public lights, for instance, had increased to the extent of 328; the total number at the end of last year being 11,411. In the natural course of events, these would suffer a reduction in future; but not to the extent some individuals would lead the public to believe. A fresh impetus had been given to the use of gas for cooking purposes. During the period under review, no less than 1345 cookers had been disposed of by the Company; bringing the total sales up to 21,261. He was told that other gas-cooker agents in the City had been extremely busy of late; all tending to increase the gas consumption—in the daytime particularly. The increase in the number of the consumers for the half year was 3084; the total now being 95,728. To meet the increased demand for gas, it was found necessary to lay during this period 62 miles of mains and service pipes; the total mileage to date being 2511. The Chairman next referred to the antagonistic feeling exhibited by those who were bidding for popularity, in taking every opportunity afforded them to attack the Company without just cause, and instanced the recent deputation to the Premier. Under the guise of obtaining a General Act to regulate gas matters, the greatest bias was exhibited towards the Company; and the Premier was quick to discern the attack. It was noticeable that when one member ventured to say a word in defence of the Company, he was quickly "sat upon." It was absurd to think that gas could be supplied in Sydney as cheaply as in England. Under the conditions regarding labour and taxation which prevailed in Australia at the present time in connection with the manufacture of gas, labour alone cost more than double what it did in England; while the necessary machinery and material which had to be imported from the Old Country, bore Customs duties up to 35 per cent. Even when it was possible to order these goods in Sydney, there was no saving in cost. The price charged for gas—viz., 3s. 9d. per 1000 cubic feet—was most reasonable under the circumstances. It could not be supplied at this price now had not the Company from time to time kept pace with the improvements in machinery introduced for cheapening gas manufacture. The new extensions at Mortlake, when in full working order, would tend further to reduce the cost of manufacture, and, as a natural sequence, the price of gas would again come under the consideration of the Board. Whenever the Company has been able to do so, the price of gas had been reduced; while the dividend had not been increased for 40 years. When the capital had been increased, the shareholders had had to pay a premium on the additional shares allotted to them. The statement that the Company's stocks had been frequently watered was without foundation. The shareholders had had to pay the full amount of their shares as they had been issued from time to time, in addition to which they had contributed no less a sum than £228,225 as "premium capital," bearing no interest or dividend whatever. In conclusion, he moved that the report of the Directors be received and adopted, and that a dividend be paid at the rate of 9s. per share free of income-tax.

The motion was unanimously adopted; and Mr. S. H. Cary was elected a Director in the place of the late Mr. J. H. Storey.

The usual vote of thanks to the Directors and officers brought the proceedings to a close.

The Hayfield Rural District Council have acquired from Mr. F. C. Arkwright, of Willersley Castle, his water-works, with water rights in Mellor. The sum to be paid for the undertaking is £3600; and by the purchase the Council hope to satisfy the demands of the inhabitants of Mellor for a better supply.

SOUTH SHIELDS GAS COMPANY.

A Year of Steady Progress.

The Annual General Meeting of this Company was held on the 24th ult.—Dr. J. F. ARMSTRONG (the Chairman) presiding.

The accounts presented showed that the revenue in the past year amounted to £93,298, and the expenditure to £70,027; leaving a profit of £23,271. The addition of the balance brought forward made a total of £31,596. The Directors proposed to declare dividends at the rate of 8 per cent. per annum on the consolidated and new stocks, 5½ per cent. per annum on the ordinary stock (both less income-tax); to pay the year's interest on the mortgages, &c.; and to transfer £500 to the insurance fund. These payments would amount to £20,858, and leave £10,738 to be carried forward. The Directors reported an increase of 13,888,792 cubic feet in the quantity of gas sold in the twelve months ended Dec. 31.

The CHAIRMAN, in moving the adoption of the report, remarked that the meeting was the fifty-fourth statutory one; and he congratulated the shareholders on having had a year of steady continuous progress. He said the most important matter under consideration by the Directors during the past few months had been how to reduce the price of gas, which they had long wished to do. There had been a great difference of opinion as to how coal prices would rule next year; and it was difficult to forecast what the cost would be. The Directors were undecided until they saw their way to contract for coals from next June to June, 1912. When these contracts were entered into at slightly reduced prices, they could form a pretty accurate estimate of the expenditure for coal; and they then decided to reduce the price of gas 2d. per 1000 cubic feet. It was interesting to note that this made the third reduction in ten years; aggregating in all 6d. per 1000 cubic feet. The 2d. now conceded would lower the revenue by about £4500 a year; but, considering the Company's excellent financial position, and the slightly reduced prices in the coal contracts, the shareholders could feel assured that the Directors had given the question every consideration. This financial result was due to three primary causes—viz., increase in the quantity of gas sold; greater efficiency in manufacturing results; and better returns from residuals. The quantity of gas sold last year showed an increase of 13¾ million cubic feet, or 2·89 per cent. more than the previous year—a result which, in face of the lengthy shipyard strike, was exceedingly satisfactory. Although so much more gas had been made and sold during the year, the actual quantity of coal and oil used had been considerably less than in 1909, due to improved manufacturing results. The effect of this was that, while the cost of coal per ton had been more, on account of the Miners' Eight Hours Act having come into operation, the total coal and oil bill was less by £521. Turning to the financial results of the year's working, the Chairman said the receipts from gas and meter-rents were £2295 in excess of those for 1909; and the amount received for residual products showed an increase of £1170. The total income for the year was £93,298, against £89,717 for 1909—an increase of £3581, or 3·99 per cent. The total expenditure was £70,027, against £68,114—an increase of £1913, or 2·81 per cent., due to repairs and maintenance of plant and apparatus. The Company now had on their books a total of 29,492 consumers. The amount carried forward was increased by £2412. After providing for the Company's obligations for the year and adding £500 to the insurance fund as proposed in the report, the reserves would be: Insurance fund, £8301; reserve fund, £1047; carry forward, £10,738—total, £20,086. He hoped before next year the cloud of uncertainty thrown over everything in the country would have lifted. There had been no peace among the coal operatives since the Eight Hours' Bill became law; and this had unsettled the coal trade, and indirectly the gas industry. The Directors wished to record the great and faithful services of their officials during the past year. The Secretary (Mr. J. H. Penney) and others were growing old in the Company's service; and the Engineer and Manager (Mr. T. H. Duxbury) had been a pillar of strength and an intelligent guide to them.

The report was adopted, the dividend recommended declared, and a vote of thanks accorded to the Directors; special reference being made to the work of Mr. Duxbury.

SUNDERLAND GAS COMPANY.

Installation of Vertical Retorts—High-Pressure Gas Supply.

In moving the adoption of the report and accounts at the annual general meeting of the Sunderland Gas Company last Wednesday, the Chairman (Alderman S. Richardson) said all went well with the Company. Coal had been bought at fairly favourable rates; and coke and other residuals had been sold at very satisfactory prices. The appointment of Mr. Norman Cox as Secretary and of Mr. Drury as Engineer had been fully justified by the results. Referring to the various works of the Company, he said the vertical retorts at Ayres Quay had so far quite realized anticipations; and the yield of gas per ton of coal carbonized showed an increase. As he stated last year, it needed several years' experience of these retorts to learn exactly as to wear and tear and depreciation. But it was enough for present purposes to say the results had justified the expenditure. The Directors had decided to lay a high-pressure main along Fawcett Street, Bridge Street, and High Street West, to enable shopkeepers and others to obtain the cheapest, most brilliant, and most effective form of illuminant; and already many had intimated their intention of availing themselves of it. Notwithstanding the depression in trade and labour difficulties, the sale of gas last year showed an increase of 19¼ million cubic feet, equal to 2 per cent., over the year 1909. The price of gas to all sections of the Company's customers had been reduced; and the net prices of 1s. 9d. to 1s. 4d. for lighting, heating, and cooking, and 1s. 6d. to 1s. 3d. for power purposes, compared very favourably with other districts. The accounts presented were so full and complete that he did not think he need trouble those present with them. They would see that the Company were in a position to pay their maximum dividend. The report and accounts were adopted; and dividends of 5 and 4¼ per cent. on the original and additional stock (less income-tax) were declared. Attention was called to the fact that the Directors had placed a substantial sum to the credit of the workmen's compensation fund; and the hope was expressed that, if the results of the current year's working were equal to those of last year, this fund would be brought up to at least £10,000. The thanks of the shareholders were accorded to the Chairman, Directors, and officials for their services to the Company.

BARNET DISTRICT GAS AND WATER COMPANY.

An Increased Dividend.

The Half-Yearly Meeting of this Company was held last Tuesday, at the Holborn Restaurant, W.C.—Mr. ALFRED H. BAYNES, J.P., in the chair.

The SECRETARY (Mr. Ernest W. Drew, F.C.A.) read the notice convening the meeting; and the Directors' report and the accounts were taken as read. In their report (for the six months to Dec. 31), the Directors stated that the yield of water from the well at Tyttenhanger had been very satisfactory; and contracts had accordingly been entered into for the erection of the engine and boiler-house, &c., and for the permanent pumping machinery. This work was being rapidly proceeded with, for use during the coming summer. They had also thought it advisable to enter into a contract for the construction of a well on the Company's land at North Mimms; and this work was also being proceeded with. The Board reduced the price of gas from 3s. 8d. to 3s. 6d. per 1000 cubic feet as from Michaelmas last. The balance standing to the credit of the profit and loss account amounted to £30,325, out of which the Directors recommended the declaration of a dividend, less income-tax, for the half year to Dec. 31, at the rate of 8 per cent. per annum on the "A" and "C" stocks, 7 per cent. per annum on the "B" stock, and £5 12s. per cent. per annum on the "D" capital gas and water stocks.

The CHAIRMAN, on rising to move the adoption of the report and accounts, expressed regret that Mr. Alfred Lass, one of the Directors, was not well enough to be present that day. Proceeding, he said it was not necessary for him to detain the shareholders with any lengthened remarks of his own. He would merely refer to a few outstanding figures which he thought were of a specially encouraging character, and which, in the judgment of his colleagues and himself, reflected very great credit on their Engineer and Manager (Mr. F. J. Bancroft) and his efficient staff. He felt sure the proprietors would agree with him that the report now before them indicated very satisfactory and substantial progress. Dealing, as usual, in the first place with the gas portion of the undertaking, he might draw attention to the fact that under the heading of capital expenditure there was an increase during the half year of £1227. This was at the rate of £251 per million cubic feet increase in the sales; and those shareholders who were observant regarding capital expenditure, would at once see that this was a low figure. If the Company could increase their business at this ratio, it would be highly satisfactory to both consumers and shareholders. Turning to the gas revenue account, he would ask them to consider the receipts; and he would remind them that a reduction of 2d. per 1000 cubic feet was given, which took effect from Michaelmas last, so that the heavier quarter of the past half year had been at the reduced price. Notwithstanding this, however, there had been an increase in the receipts from public and private lighting of £503, as compared with the corresponding half of 1909; the sale of gas having increased by 5 million cubic feet, or over 6 per cent. Rentals from meters and stoves were also more, due to a satisfactory growth in the number of consumers. The receipts from residuals all showed increases, which amounted in the aggregate to £205 more than in 1909; the total receipts being equivalent to 64 per cent. of the cost of the coal. The total increase in the gas revenue for the past half year had been £837. He would not trouble them with all the items on the expenditure side; but if they took the outlay on manufacture and distribution of gas together, the total cost was £25 less than in the same period of the previous year. Having regard to the fact that the make of gas had increased by 6¼ million cubic feet, this must be considered as very satisfactory. The gas made per ton of coal had been 12,872 cubic feet, as against 12,295 cubic feet in the corresponding half of the year 1909; and the gas sold per ton was now 11,831 cubic feet. The statutory standard of illuminating power had been well maintained, as shown by the Engineer's own reports, and confirmed by the independent examiner appointed by the East Barnet Valley Council. He need not point out to those who were acquainted with carbonizing that this result indicated a very high state of efficiency in the carbonizing department; and great credit was due to the Engineer and staff. Rates and taxes were £77 more; but the other items in the account were normal. The result was that £4073 was carried to net revenue, as against £3405 in 1909—an increase of £668. At this point he would like also to state that the show-room and distribution department continued to give increasing satisfaction to the consumers, who were now seeing the many advantages to be derived from availing themselves of the Company's expert advice. With the further view of giving the consumers the best possible results in the consumption of gas, the Directors had recently arranged to clean, overhaul, and adjust incandescent gas-burners free of charge for labour. In each case the consumer was consulted before any renewals were made; and these only were charged for. Though this advantage had been in operation for a short time only, it was giving great satisfaction; and a considerable number of consumers had availed themselves of their offer.

Turning now to the water revenue, he was pleased to say that the number of water consumers was constantly increasing; and the Company had as a result a larger rental by £793. It was satisfactory to note that the allowance for water-rates on empty houses was less than last year. As to the expenditure, the total charge for maintenance was £7311, being a decrease of £422 on the corresponding half of the previous year. Management expenses had increased by £96; and the total expenditure was £8546, as against £8872, with the pleasing result that the profit on the water portion of the undertaking amounted to £11,272, or an increase of £1138 over the corresponding half year. The

profit on gas and water together, with £198 from fittings, came to a total for the six months of £15,544. Now, before dealing with the allocation of these profits, he would ask the shareholders to consider the capital expended on water account, which they would see had been £10,117 on works and £17,594 on mains. This large expenditure was due almost entirely to the new work the Company were now carrying out at Tyttenhanger, and which was referred to in the report. They had still to complete the buildings, and also to instal the pumping machinery; so that the expenditure at this station would be heavy. But the Board had every reason to believe, from the report presented to them by the Engineer, that it was money well spent, and that they would soon be in a position to supply their district from this source. The Directors were fully alive to the responsibility of furnishing their large and growing district with an ample supply of water; and they could not be accused, he thought, of not having spent money freely towards this object, both on new works and in re-organizing their distribution department, so as to comply with the last Act obtained by the Company. At present, they were practically free from complaints throughout their whole district; and satisfactory returns were being made by the District Councils as to the efficiency of the supply.

From what he had stated, the proprietors would see that the Board had constantly studied the interests of their consumers by giving a reduction in the price of gas and making provision for the water supply; and after full consideration, they felt that the time had arrived when the proprietors should also somewhat share in the increased prosperity of the Company. They had therefore decided, as would be seen from the report, to recommend an increase in the dividend. As he had already remarked, the profit on gas, water, and fittings for the past half year amounted to £15,544. From this sum had to be deducted income-tax and interest amounting to £2443, leaving a net profit of £13,101. The increased dividend as recommended in the report would take £10,872, leaving a surplus of £2229. After transferring £2000 to the contingencies fund, there would be a surplus of £229 to be added to the balance of £19,225 brought from the last account, making a balance to be carried forward to the next half year of £19,454. Referring to the extension work carried out during the past six months, he might mention that they had laid 3470 yards of gas-mains and 15,332 of water-mains. There had been 213 new services laid for gas, and 299 for water; and 17 new public lamps had been erected. The quantity of water pumped into the district was 317,796,000 gallons, which was an increase of 765,000 gallons over the previous year.

The DEPUTY-CHAIRMAN (Dr. J. W. L. Glaisher) seconded the motion, which was at once carried unanimously.

Proposed by the CHAIRMAN, and seconded by Dr. GLAISHER, the dividends mentioned in the report were declared.

On the motion of the CHAIRMAN, seconded by Dr. GLAISHER, the retiring Directors (Mr. J. L. Chapman and Mr. F. Lennard) were re-elected, as was the retiring Auditor (Mr. C. P. Crookenden), on the motion of Mr. F. R. SMITH, seconded by Mr. C. B. O. CLARKE.

Mr. J. PLUMMER said it was now some fifteen years since the proprietors increased the fees of the Directors; and in the interval the business had progressed enormously. In 1894, the gas revenue was £18,356, whereas it was now £37,818; while the water revenue had similarly increased from £16,924 to £39,219, and the capital had gone up from £230,348 to £474,218. To his mind, the time had now arrived when the shareholders should take into their favourable consideration the remuneration paid to the Board, who were at present receiving £900 a year. He therefore begged to move: "That the remuneration of the Directors be increased by the sum of £250 per half year; and that the fees be paid free of income-tax."

Mr. S. CUTLER, in seconding, remarked that the Company were served by a Board of Directors second to none. There were on it men of great experience in the gas world; and the business was well managed by them. For very many years past he had known something of the Directors of the Barnet Company; and they had always been men well qualified to fill the position.

The proposition was cordially agreed to; and the CHAIRMAN briefly acknowledged this mark of appreciation of the Board's efforts on the part of the shareholders.

Mr. A. F. PHILLIPS proposed a vote of thanks to the officers. The Chairman, he said, had gone so fully into the excellent results obtained by Mr. Bancroft at the gas-works, that there was very little left for him to say, except to emphasize the Board's appreciation of the services rendered by their Engineer. Not only had he secured an almost record make and sale of gas, but he kept the works in excellent order, and had organized a most efficient staff to obtain new consumers. In fact, his distribution department was as excellent as his manufacturing department. Then, again, during the past half year they had called upon Mr. Bancroft to devote a very great deal of time and attention to the carrying out of the new water-works at Tyttenhanger, which he (Mr. Phillips) could assure the proprietors was one of the most important undertakings that the Company had ever been engaged upon, since on these works depended to a very great extent the future success of the Barnet Water Department. Mr. Bancroft was carrying out most excellent work for the Company in this connection. The rapidity with which he had the water main laid from Tyttenhanger to Barnet surprised the Directors. He must also mention the services of the Secretary and of the Accountant (Mr. Wright).

Mr. F. LENNARD seconded the proposition, which was unanimously agreed to.

Mr. DREW, Mr. BANCROFT, and Mr. WRIGHT returned thanks for the vote.

On the motion of Mr. CLARKE, a vote of thanks was also accorded to the Chairman and Directors, and duly acknowledged.

An inquest was held by the Oxford City Coroner last Tuesday, concerning the death of Emma Hazell, aged 64, a widow of independent means, who was found dead in her house the previous morning. She was attended by a nurse, who could not obtain access to the house on the day named. By means of a ladder, however, she got in, and found the deceased dead in the bath-room, with two of the gas-burners turned on full and unlighted. Death was due to gas poisoning. A verdict of "Suicide while of unsound mind" was returned.

TWENTY-FIVE YEARS' GAS PROGRESS AT BRIGHTON.

In the last number of the "JOURNAL," the holding of the half-yearly general meeting of the Brighton and Hove Gas Company on the previous Friday was briefly recorded. From a printed report of the proceedings which has reached us, we extract the following particulars in regard to the progress of gas supply in Brighton in the past twenty-five years, furnished by the Engineer and General Manager (Mr. Joseph Cash, M.Inst.C.E.) in responding for his department to a vote of thanks accorded to the officers and staff.

Mr. Cash said he had arrived at the end of his twenty-fifth year as Engineer and General Manager; and it might perhaps be interesting if he gave a few figures showing what had taken place during the quarter-of-a-century. When he succeeded Mr. J. B. Paddon in 1886, the sale of gas was 7001 million cubic feet; whereas last year they sold 12,179 millions, an increase of 82 per cent. Many other companies had done better; but Brighton was a different place from a London suburb or some growing provincial towns. This increased sale of gas had taken place in face of one of the keenest oppositions on the part of electricians that he thought existed in the kingdom. During the period referred to, the capital had gone up only 23 per cent.; whereas in 1886 the capital per million cubic feet was £716, it was at present only £551. The conditions of business were now altogether different from what they were when he started. New phases in the means of selling gas had come about, and great developments had taken place. The length of mains had been increased from 128 miles to 203 miles. As electric competition came to the centre of the town, so they had to extend their mains into the outer area. The number of consumers, which was 14,053 in 1886, had grown to 39,926, mainly due to prepayment meters and small consumers. Another feature, and that a very marked one, was that the consumption per consumer had decreased from 46,526 cubic feet to 31,182 cubic feet. This was owing to the small consumers coming in in large numbers. It had made a great deal of additional work; but he was glad to say that the consumption of gas per mile of main, notwithstanding competition, had increased from 5¼ millions in 1886 to 6½ millions at the present time. These results would not have been obtained but for the loyal support of the officers under him, with whom the vote of thanks would be shared, and also for the hearty co-operation of the Board.

EXETER GAS COMPANY.

Increased Gas Consumption—Reduction in Price.

The Annual Meeting of the Exeter Gas Company was held on Monday last week, under the presidency of Mr. G. Hardy Harris. The Directors reported that the sale of gas during the past year had increased by nearly 6 million cubic feet, which was largely attributed to the policy adopted by the Board of reducing the price of gas whenever possible. As the result of economies in working, they were able to announce a further reduction from 2s. 7d. to 2s. 6d. per 1000 cubic feet from Christmas last, which it was hoped would have the effect of still further extending the Company's business. The Gas Companies' Standard Burner Bill became law last year, notwithstanding the determined and prolonged opposition of a few local authorities; and both the Company and the consumers would share in the saving effected by the quality of the gas being measured by a method suited to modern requirements. The Directors recommended the payment of the usual dividends of 10 and 7 per cent. per annum on the original and ordinary shares, together with such additional dividend as would reimburse the shareholders for the deductions for income-tax on the dividends payable on the original stock and new ordinary shares. The Chairman, in moving the adoption of the report, congratulated the shareholders on the satisfactory position in which the undertaking stood. Having touched on the chief matters mentioned in the report, he drew attention to the extra expenditure entailed at the works in connection with the handling of coal, which it was anticipated would effect a saving in labour. There were 11,129 meters in operation, which was an augmentation to the extent of 5 per cent. as compared with the previous year; while the cookers showed an increase of 7 per cent. Having referred to the excellent manner in which the Manager (Mr. W. N. Westlake) and staff had looked after the interests of the shareholders, the Chairman formally moved the adoption of the report and the payment of the dividends recommended. The motion was carried unanimously.

ASCOT DISTRICT GAS AND ELECTRICITY COMPANY.

A Thirty Per Cent. Increase in the Sale of Current.

The Ordinary General Meeting of this Company was held last Tuesday, at the Offices, No. 50, Cannon Street, E.C.—Mr. JOSEPH MANWARING in the chair.

The SECRETARY (Mr. W. A. Schultz, F.C.A., J.P.) read the notice convening the meeting and the minutes of the previous meeting; and the report and accounts were taken as read. These showed, for the year ended Dec. 31, a profit on the gas account of £4601, and of £792 on the electricity account. After providing for every charge against the year's working and interest on mortgage debenture stock and loan, and the payment of an interim dividend at the rate of 5 per cent. per annum for the half year ending June 30, and setting aside a sum of £100 for reserve for renewal of plant, there remained a balance of £2426 at the credit of profit and loss account, out of which the Directors recommended the payment of a dividend at the rate of 6 per cent. per annum for the six months to Dec. 31, making 5½ per cent. for the year, and leaving £101 to be carried forward. The demand for both gas and electricity continued to progress satisfactorily.

The CHAIRMAN, in moving the adoption of the report and accounts,

remarked that the Board were presenting for the approval of the shareholders accounts which he thought he was fairly justified in describing as satisfactory. He was glad that the scheme of adding the production of electricity to that of gas had met with considerable success—so much so, that several gas companies had obtained similar powers, and others were now applying to Parliament for them. It would be seen that the sale of electric current had increased more than 30 per cent. during the past year. Applications were still coming in; and the revenue was steadily increasing at a very satisfactory rate. The profit from electricity was £792, as against £374 in the previous year; but they must remember that charges which were common to both gas and electricity had to be allocated according to the Company's Act much to the disadvantage (at present) of the electrical department. Otherwise a still larger profit would be shown. This had not caused the output of gas to suffer in any way; there being an increase of 200,000 cubic feet in the sale to private consumers. The results for tar showed an increase of £113, and sulphate of ammonia £121. The total profit on the gas account amounted to £4600. The Directors declared an interim dividend at the rate of 5 per cent. per annum for the half year to June 30, and recommended the payment of 6 per cent. for the second half year, making a total of 5½ per cent. for the year—thus maintaining the dividends at what they have been since June, 1905. The capital expenditure on the gas account had been £803, and on the electricity account £993. The Directors were replacing some of the original direct-fired retorts by others on the regenerative system, whereby a great saving would be effected, both in the gas made and fuel used; and to pay for this, and to clear off the bank loan, the shareholders would be asked to authorize the issue of further capital, which, if sanctioned, would be sold by public auction during the next month or so.

Mr. Henry Woodall seconded the motion.

Mr. C. Webb inquired whether people were abandoning gas to take on electricity; and also what was the price of gas, and when the last reduction took place. Then the salary of the Secretary appeared to be put down under gas, but not under electricity.

The Secretary explained that there had been no reduction in price during the past year. Except in a few cases, where they put on electricity gas was not used before. He thought the chief reason why the sale of gas had not gone ahead to any extent—though the sale had increased 200,000 feet during the year—was because there was no building going on of any moment. The only building taking place was in the Sunningdale district; and there the Company were laying on electric light.

Mr. Webb: My contention is that the high price you charge prohibits people from taking gas.

The Engineer and Manager (Mr. A. E. Brooks) remarked that the price of gas was 4s. 3d. per 1000 cubic feet, subject to a discount according to consumption. With the class of consumers the Company had, he did not think a reduction of 3d. per 1000 cubic feet would make a great difference in the quantity of gas that was used. Of course, some of the electricity consumers had reduced their gas accounts; but this had only happened to a very small extent.

Mr. Webb then asked if it was compulsory to put the new stock up to auction.

The Secretary replied either to auction or tender.

Mr. Webb: Then I would throw out a suggestion that the shareholders be invited to tender.

The Chairman promised that the Board would take this matter into consideration.

The Secretary explained that in the electricity accounts the Secretary's salary was under the head of "Salaries, £147 16s. 9d." A proportion was allotted to the electricity revenue account in accordance with the amount of the capital; and it was the same with the Engineer's salary. The gas accounts were made out exactly on the lines of the Gas-Works Clauses Act; and the electricity accounts strictly followed the Electricity Act.

The resolution was then put and carried unanimously.

On the proposition of Mr. Woodall, seconded by Mr. F. R. Smith, a dividend for the half year at the rate of 6 per cent. per annum, less income-tax, was declared.

The retiring Directors (Mr. Manwaring and Mr. Alfred Kitt) were re-elected; and the Auditors (Mr. T. A. Welton and Dr. H. J. Strong, J.P.) were also re-appointed.

Votes of thanks were passed to the Chairman and Directors and to the officers and employees for their services to the Company last year.

A special general meeting was then held, at the opening of which,

The Secretary explained that the Company were owing the National Provincial Bank of England at December £3000. Constant extensions of a small nature were being carried on; and, as the Chairman had explained, retort-house improvements were in hand which necessitated the expenditure of some further capital, though this work was not altogether on capital account. Under these circumstances, the Directors desired authority to issue more capital, though the whole amount would not be raised at once.

The Chairman then moved that the Directors be authorized to raise additional capital by the issue of £2500 of 4½ per cent. perpetual debenture stock, and 450 £10 7 per cent. ordinary shares.

Mr. Kitt seconded the proposal; and it was at once agreed to.

Coventry Water Supply.—It has been decided by the Coventry City Council, on the recommendation of the Water Department, to spend £2000 in the purchase of additional land for the erection of another reservoir at Coundon. The Committee's recommendation has arisen in consequence of the powers obtained by the Corporation under the Act of 1907, when the supply of water from Shustoke, by arrangement with the Birmingham Corporation, was obtained. The present Coundon reservoir has a storage capacity of about 3 million gallons, or little more than a day's supply. During the present year, the supply of water to consumers occasionally reached 2½ million gallons per 24 hours. The area of the land proposed to be purchased is slightly over 6 acres; and the price works out at £326 per acre. The Council unanimously agreed to the purchase.

EXTENDED AREA OF THE UXBRIDGE GAS COMPANY.

In the report presented at the recent meeting of the above-named Company, the Directors stated that the accounts for the year ended the 31st of December last showed a net profit of £7931, which added to the balance of £25 brought forward gave a total of £7956. Deducting £831 for interest, there was left £7125 available for distribution. The Directors therefore recommended the payment of a dividend, less income-tax, at the rate of 6 per cent. on the consolidated stock, which would absorb £6749, and leave a balance of £376 to carry forward. Allowing for the interim dividend at the rate of 2¾ per cent. paid in September last, there remained a balance of 3¼ per cent. payable. Acting in the interests of the Company, the Directors had acquired the undertaking of the Amersham Gas Company, Limited, and were applying for a Provisional Order for extending the limits to include the parishes of Chenies, Amersham, Penn, Little Missenden, Great Missenden and part of the parish of Hughenden, in Buckinghamshire; and the parishes of Flaunden and Sarratt, in Hertfordshire.

The Chairman (Mr. H. E. Jones), in moving the adoption of the report, said the shareholders would see from it that the Directors had a plum for them; but before they had been able to offer it, they had to go through the process of reducing the price of gas by 1d.—from 3s. 7d. to 3s. 6d. This showed the advantage of the sliding-scale to the consumers. When the price of gas was reduced, the shareholders' dividends increased; so that it was to the advantage of all to lower the price. Dealing with the capital account, he pointed out that the increases were chiefly due to purchase of stock. They had fixed 683 new meters, and 400 cookers and stoves, and they had 906 extra consumers. Of course, they had a corresponding number of service-pipes to put in; and, as a matter of fact, they had laid or relaid something like nine miles of mains. They had, as mentioned in the report, since last year acquired the undertaking of the Amersham Gas Company, at the cost of £5500. This had not yet given them a large amount of profit, as they had only had it a few months; but in future years they would reap the benefit. In this part of Bucks they found that the working man wanted gas; but he would not pay 5s. 6d. per 1000 cubic feet for it. If, however, it was offered to him at 3s. 6d., as the Company were doing, he would at once accept it. In conclusion, the Chairman referred to the excellent work and hearty co-operation of the Manager (Mr. Charles Hulme), Secretary (Mr. G. J. Bristowe), and staff.

The report was adopted. At a subsequent special meeting, the shareholders approved of the Draft Provisional Order referred to in the report.

GAS SUPPLY OF NEW YORK.

The Work and Projects of the Consolidated Gas Company.

At the Annual Meeting of the Consolidated Gas Company of New York a few weeks ago, the report presented furnished the following particulars in regard to the work of the past year and the schemes in hand for improving the plant.

Dealing first with the decision of the Supreme Court of the United States reducing the price of gas from $1 to 80c. per 1000 cubic feet, the report says it was held that if, as the result of working under the new conditions, the Company found they could not obtain a fair return on the value of the property employed in the gas business, they were to have an opportunity of again presenting their case to the Court. Notwithstanding the fact that their earnings for the past year amounted to less than 6 per cent. on the value of their property, as established by the Court, it is hoped that in time, as the result of the economies which are being effected in the cost of manufacturing and distributing gas, and by reason of the more general utilization of gas for other than illuminating purposes and the resumption of greater business activity, their earnings will approximate a fairer return on the value of their gas property. The Company will await the development of these elements before considering further the privilege granted them by that decision.

The accounts receivable decreased greatly last year, owing to the long-deferred payment of the city's lighting bills. The Company earned $2,151,421, after deducting the reserve for renewals and contingencies; to which should be added, for the purpose of determining the earnings applicable, in accordance with the decision of the United States Supreme Court, the surplus earnings of the Astoria Light, Heat, and Power Company $261,044, and the interest received on the investment in the stock and obligations of that Company ($633,983)—making the total earnings from the Company's gas business $3,046,448 for the past year. This was equivalent to about 4·10 per cent. on the value of the tangible and intangible property employed in the manufacture and distribution of the gas sold by the Company. Dividends paid in the year on the Company's capital stock aggregated 4½ per cent.; amounting to $4,491,632.

Negotiations between the City and the Company and their affiliated Gas and Electric Companies for the settlement of the claims existing against the City for lighting the streets and public buildings, covering a period of more than seven years, and of the City against the Companies for special franchise taxes for the same period, were brought to a successful termination on April 19 last year. The settlement covered the special franchise taxes and the city lighting bills of all the Gas and Electric Companies with which the Consolidated Gas Company is affiliated, and resulted in the payment by the Companies of special franchise taxes aggregating $7,428,084, and the payment by the City, on account of claims against it for gas and electric service, of $6,999,686, including interest; leaving a balance of principal and interest due from the City, subject to final adjustment, of about $500,000. The number of actions relating to gas and electric franchises pending in the Courts at the time of the foregoing settlement was 72, and the number relating to gas and electric bills was 54. All of them were terminated by the settlement.

The shafts for a new tunnel which will connect the gas-main system in Astoria with that in the borough of the Bronx, are in process of

excavation. There is only one completed tunnel, through which the gas manufactured at the Ravenswood and Astoria plants can be conveyed to the borough of Manhattan. The present daily capacity of these plants—27 million and 20 million cubic feet respectively—represents nearly one-half of the total of the plants which now supply gas to consumers in New York City. With the completion of the second unit at Astoria, now in course of construction, having a capacity of 20 million cubic feet, the percentage of gas delivered in New York City from Long Island will be very greatly increased. Plans for a water-gas plant of 40 million cubic feet capacity at Astoria have been prepared, and the construction of half of the unit has been begun. It will probably be completed so as to be available in the winter of 1911-12.

Notwithstanding the relatively small increase in the output of gas since 1907, the Company realize that the resumption of business activity, after so long a period of comparative stagnation, is likely to be attended with a substantial increase in the demand for gas for industrial and domestic purposes, and that they should be prepared to meet a much greater demand, which may at any time be made upon them. The Companies installed 103,067 gas appliances last year; and the combined sales of gas of all the various Companies aggregated 27,217,105,473 cubic feet.

WAKEFIELD GAS COMPANY'S AFFAIRS.

Successful Assessment Appeal—New Purifying Plant.

At the Ordinary Half-Yearly General Meeting of the Wakefield Gas Company, the Chairman (Dr. W. A. Statter, J.P.), in moving the adoption of the balance-sheet and accounts, congratulated the shareholders upon the satisfactory nature of the trading in the six months ended Dec. 31. He said that they had had an increase of 3·12 per cent. in the quantity of gas sold, while there was a decrease of 0·57 per cent. in the make; showing a satisfactory diminution in the leakage, due to the strenuous efforts on the part of their Engineer and Manager (Mr. Harry Townsend) and staff to effect this object. The Assessment Committee having increased the Company's already inflated assessment by no less than £2121, the Directors determined to contest this to the utmost; and they obtained the eminent assistance of Mr. Corbet Woodall in the matter. After several interviews with him, accompanied by their Manager and the Union Valuer, the Assessment Committee decided that the increase could not be maintained; and the old valuation was reverted to. The best thanks of the Directors were due to Mr. Woodall and to their Manager for bringing this matter to so satisfactory a conclusion without the trouble and expense of a contest at Quarter Sessions. The new purifiers rendered necessary by the explosion on the 20th of June were put into operation on the 21st of September, which was very quick work. They were a great improvement on the old boxes, and would suffice for the needs of the Company for another twenty-five or thirty years. They were able to work them according to the most modern methods, with the result that they expected to save more than £400 a year in wages, while at the same time very materially reducing the nuisance to their neighbours; so that what at first looked like a disaster of prime magnitude had really proved a blessing in disguise. In conclusion, the Chairman mentioned that an agreement had been come to with the Stanley Urban District Council, whereby they pledge themselves to light with gas all the public lamps in this important district for the next fourteen years; dropping their own Electric Lighting Order, which had at one time threatened the Company with serious competition. On the motion of Mr. P. Mountain, seconded by Mr. G. M. Lawrence, a cordial vote of thanks was passed to the Chairman and Directors for their excellent conduct of the Company's business during the past half year. In responding, the Chairman moved, and the Deputy-Chairman seconded, a hearty vote of thanks to the Engineer and Manager and to the Secretary (Mr. R. B. Wilson) and their respective staffs; the Chairman paying a high tribute to the technical ability of Mr. Townsend in connection with the appeal against the assessment and the erection of the new purifying plant.

CO-PARTNERSHIP AT LONGWOOD.

The Annual Meeting of the Longwood Gas Company was presided over by Mr. Robert Thornton, who, in moving the adoption of the report and accounts, said the Board had been able to fulfil the prediction given a year ago that on this occasion they would be able to reduce the price of gas and recommend the payment of the maximum dividend authorized by the Company's Act of 1902. By this Act, the Company were empowered to pay 2s. 6d. per cent. for each 1d. reduction in the price of gas below the standard price of 3s. 1d. From March 31 next, the price would be 2s. 6d. per 1000 cubic feet, instead of 2s. 9d.; and consumers who paid their accounts within the discount period would have 1d. per 1000 feet rebate. To slot-meter consumers 1d. in the shilling discount would be given. With the reduced prices, no gas company in Yorkshire of a similar size would be supplying gas at as low a net average charge. Power users were already supplied at prices ranging from 1s. 11d. down to 1s. 8d. per 1000 cubic feet net. It was the endeavour of the Board to serve the district well and to keep on good terms with both consumers and local authorities. As regarded electrical competition, he did not fear it if it was considered on equal grounds, and from a business aspect. The quantity of gas made during the past year was 122,265,000 cubic feet; and the number of tons of coal carbonized, 11,540. The make per ton was 10,595 cubic feet, which was the highest yet obtained, and spoke well for the management of the undertaking. The quantity of gas sold showed an increase of 9,218,600 cubic feet, or 9·21 per cent. There was an increase of 124 in the number of consumers.

The report was adopted; and a dividend at the rate of 5½ per cent. was declared. A stockholder having asked for particulars of the co-partnership scheme, the Engineer, Manager, and Secretary (Mr. J. H. Brearley) explained its provisions. He said that, starting with the standard price of 3s. 1d. per 1000 cubic feet, each employee received a bonus of 1 per cent. for each 1d. reduction. They therefore started with a bonus of 4 per cent.; and when the price was 2s. 6d., the bonus would be increased to 7 per cent. The scheme consolidated the various interests affected by the sliding-scale, for consumers, stockholders, and employees alike benefited when the price of gas was reduced. Of each 1d. reduction, however, more than three-fourths of the benefit went to the consumers.

Thanks were accorded to the Chairman and the Engineer and officials for their services during the year. In responding, Mr. Brearley said the Directors had a scheme under consideration for giving certain portions of the district a supply by high pressure. Gas lighting was holding its own throughout the country, notwithstanding competition; and the state of the industry was never in a more flourishing condition. Inventions were constantly being made which improved the efficiency of both lighting and heating appliances; and consumers before deciding upon any change would be well advised to consult the Company's officials as to the latest appliances available for any particular purpose.

THE BISHOP'S STORTFORD GAS AMALGAMATION.

In pursuance of the provisions of the Bishop's Stortford, Harlow, and Epping Gas and Electricity Act of last session, an ordinary meeting of the proprietors was held at No. 5, Great Winchester Street, Old Broad Street, E.C., last Wednesday, to elect Directors and Auditors, and to determine their remuneration and that of the Directors professionally engaged in connection with the passing of the above-named Act and with the amalgamations with other Gas Companies. The Directors presented a report, in which they congratulated the proprietors upon the complete success of the Company's application to Parliament. By the terms of the Act, the undertakings of the Bishop's Stortford, Harlow, Epping, and Ongar Gas Companies were amalgamated as from Jan. 1 last, and those of the Newport (Essex) and Much Hadham Companies purchased on agreed terms. The Act empowered the Company to create and issue ordinary and preference capital to the extent of £240,000, including the sum of £104,568 representing the capital to be issued to the shareholders of the Amalgamated Companies and the Newport Company; and authorized the Company to exercise borrowing powers to the extent of £80,000, inclusive of the sum of £14,825 already borrowed by the Amalgamated Companies. The accounts for the period ended Dec. 31, 1910, of the several Amalgamated Companies, duly audited, had been forwarded to each shareholder in the Company in which he was interested. As from the 1st of Jan., the price of gas was reduced from 3s. 9d. to 3s. 8d. in the Harlow and Sawbridgeworth district (being the rate charged in the Bishop's Stortford and Epping districts), from 5s. 3d. to 4s. 6d. at Much Hadham, and from 5s. to 4s. 6d. at Newport. Mains have been laid from the works at Bishop's Stortford to connect with the Harlow Company's mains at Sawbridgeworth, and with the Much Hadham Company's mains at Much Hadham; and these districts are now being supplied with gas from the Bishop's Stortford works.

The accounts of the Amalgamated Companies furnished the following particulars: The revenue of the Bishop's Stortford Company for the six months ended Dec. 31 last was £6004; the expenditure, £4408; the balance, carried to the profit and loss account, £1596; and the balance of net profit, £2187. The Harlow Company's revenue for the past year was £4452; the expenditure, £3221; the balance carried to the profit and loss account, £1231; and the balance of net profit, £1044. The Epping Company's figures for the past year are: Revenue, £4753; expenditure, £3251; balance, £1502; balance of net profit, £1075. The accounts of the Ongar Company are for the nine months ended Dec. 31. The revenue in the period was £1486; the expenditure, £951; the balance, £435; and the balance of net profit, £456.

COMPRESSED GAS FOR WEST BROMWICH.

At the Meeting of the West Bromwich Town Council last Wednesday, the Gas Committee, in their report, recommended that £1000 should be allocated out of the profits of the gas undertaking in relief of the rates of the borough; also that a main should be laid in the High Street for the supply of compressed gas at the rate of 3s. 2d. per 1000 cubic feet. The Mayor (Mr. J. Brockhouse), in moving the adoption of the report, pointed out that the amount the Committee were granting out of the gas profits was the same as last year. Alluding to the supply of compressed gas, his Worship said the gas was in use in many important towns in the country, and, so far as he could see, it was going to be a good thing for illuminating purposes. He complimented the Engineer and Manager (Mr. Harold E. Copp) on the up-to-date manner in which he was controlling the undertaking, and said the Gas Committee were proud of him. The gas undertaking was suffering somewhat through the existence of incandescent burners, which used less gas than those of the old type; and in the case of compressed gas the quantity would be considerably reduced. The price of compressed gas was 3s. 2d. per 1000 cubic feet, compared with 2s. 8d. for ordinary gas; but its illuminating power was about 3 to 1 greater than that of ordinary incandescent burners. The Committee had decided that where anyone had two kinds of lights, both would be taken into consideration, so that there would be no loss by installing compressed gas. The report was adopted.

The report of Wilson's and Union Tube Company, Limited, for the year to Dec. 31 last states that the balance at credit of profit and loss account from the previous year was £3544, and the gross profit for the year amounted to £5415—making, together, £8959. Allowing £3000 for depreciation, and deducting £2500, paid as preference dividend, the net balance for disposal amounts to £3459. The Directors recommend a further payment of preference dividend for the half year, absorbing £2500, and that £959 be carried forward.

BIRMINGHAM GAS DEPARTMENT STAFF DINNER.

The Annual Dinner of the Staff of the City of Birmingham Gas Department took place on Monday, the 27th ult., at the Grand Hotel, Birmingham. The Secretary and Manager of the Department (Mr. R. S. Hilton) presided over the gathering, which numbered nearly 200. Supporting him were the Chairman (Alderman Sir Hallewell Rogers) and other members of the Gas Committee. Among the guests were the Lord Mayor of Birmingham (Alderman W. H. Bowater), Mr. H. E. Stilgoe (the City Engineer and Surveyor), Mr. M. Pollack (who acted as Chairman of the Gas Committee from 1884 to 1898), and Mr. Edwin Smith (who filled the post of Secretary to the Department from 1878 to 1901). Mr. F. J. Bywater (Engineer of the Saltley Gas-Works) proposed "Our City;" and the toast was acknowledged by Mr. Bowater, in a speech full of humorous anecdotes, in which he traced the history of gas lighting in Birmingham. The toast of "The Gas Committee" was proposed in a felicitous manner by Mr. S. R. Barrett, who remarked that just as their leaders were keen to maintain the prominence and success of the huge commercial undertaking which had been entrusted to them by the City Council, so also were the members of the staff of the Gas Department anxious to maintain it as the leading department of the City of Birmingham. They were proud to serve the City of Birmingham, delighted to follow the leadership of Sir Hallewell Rogers, and most happy in working under their present chief, Mr. Hilton. Sir Hallewell Rogers responded, and thanked the staff, on behalf of his fellow members of the Gas Committee and himself, for the manner in which they had received the toast. There had, he said, always been the most cordial relationship between the Committee and the staff of the Gas Department; and never had it been more cordial than at the present time. Perhaps they were bound together by the common sorrow they all shared in the death of their respected Secretary, Mr. G. Hampton Barber, whose loss the department had felt very much indeed. One thing he could claim the Gas Committee had done, and done well, was the securing of Mr. Hilton. The more they had seen of him, the more he had endeared himself to them all. The success of the gas undertaking had been due to the combined working of every member of the staff; and he wanted to take this opportunity of warmly thanking the staff for their co-operation in the interregnum between the death of Mr. Hampton Barber and the appointment of Mr. Hilton, during which they had no Secretary and Manager. He could not pick out any particular members; but he should like to say that Mr. W. Wastell was of great assistance. He had a great belief in the future of high-pressure gas, in which department he thought the developments would be enormous. They were expecting great things from Mr. E. W. Smith and his high-pressure gas laboratories. At the works they had, he considered, the best staff of able Engineers that could be found in the gas undertakings of the country. Mr. Edwin Smith proposed "Our Chairman," which was acknowledged by Mr. Hilton. The speeches were interspersed with musical items of an enjoyable nature, contributed partly by members of the staff.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

It may be of general interest to know that it was reported to the Edinburgh and Leith Gas Commissioners on Monday that the Board of Inland Revenue have withdrawn their demand that the Commissioners should make a return, under the Finance Act of 1910, of the capital value of the Commissioners' gas and water pipes laid in the public highways. The Works Committee reported that a Sub-Committee, which was appointed on Dec. 12 last, to consider and report as to the best and most economical burner to use with the new quality of gas now being produced at Granton, had reported that, after consideration, they had resolved to recommend that the Commissioners should continue to supply the burner at present in use, as, after exhaustive tests, it had been found to yield the most satisfactory results. This was approved of. The burner, it was explained, was an adaptation. Remit was made to a Committee to consider and report as to whether the printed minutes should disclose the purchase price of stores and other articles bought by the Commissioners. The Commissioners delayed, till the expiry of twelve months' experiments with vertical retorts at the Granton Gas-Works, consideration of a report prepared, as instructed, by the Engineer; and also of a further report to be prepared and submitted.

The proposal to erect an installation of vertical retorts at the Dawsholm Gas-Works, Glasgow, capable of producing between 4 and 5 million cubic feet of gas per 24 hours, was sanctioned by the Town Council on Thursday. The estimated cost is £25,000. Mr. Alex. Wilson, the Engineer, states that, as has been proved in the trial setting at the Temple Works, the vertical-retort system, in addition to producing a better quality of coke, gives a larger yield of sulphate of ammonia and a better quality of tar. It also gives an increased make of gas per ton of coal of from 500 to 700 cubic feet over the present production, which will save from 10d. to 1s. per ton in the cost of manufacture, and, in addition, there will be practical freedom from dust and smoke, as compared with present methods.

The Gas Committee of the Glasgow Town Council this week recommended that a sum not exceeding £525 should be contributed to the fund which the Institution of Gas Engineers are raising to bring the advantages and utilities of gas more prominently before the public. The intimation which was made to the public last Monday was to the effect that the Committee had agreed to recommend that, "in the meantime, a subscription of 500 guineas be given to the fund; being at the rate of 1s. 6d. per million cubic feet of the present annual production of gas in the city."

In the Council, Bailie Paxton, the Convener of the Gas Committee, moved adoption of the recommendation. He indicated that the fund was being raised for the purpose of increasing the commercial usefulness of gas undertakings. The Institution of Gas Engineers had already received promises of £6714. It was proposed to institute a

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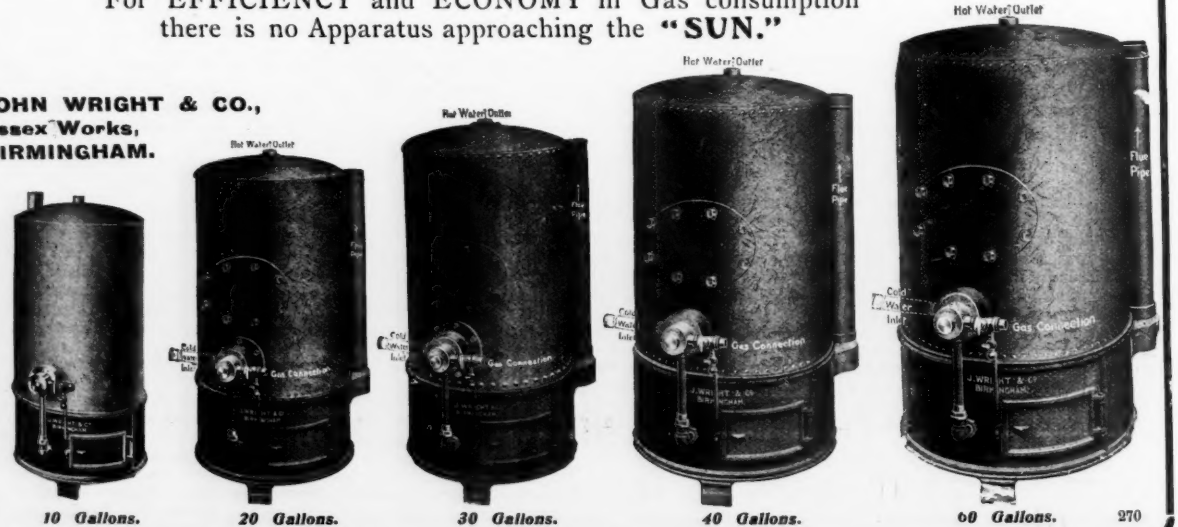

10 Gallons. *20 Gallons.* *30 Gallons.* *40 Gallons.* *60 Gallons.* 270

complete and wholesale system of advertising. Some members might ask why the Gas Committee were not themselves advertising in the city. He should like to tell them that advertising would be done by the Institution in a much more comprehensive style, by expert advertisers. Mr. Irwin moved that no action be taken in the matter. The proposed contribution was nothing more nor less than a contribution to private enterprise. Why should Glasgow subsidize the Institution of Gas Engineers? If the Gas Committee could not administer advertising funds in their own city, it was high time the Committee was reconstituted. They could spend the money to far better advantage within the city. The amendment was carried by 27 votes to 26; so that the proposal of the Gas Committee was not adopted. This is a pity, because the Institution are to meet in Glasgow this year; and it certainly would look well, and be to the credit of the city, if it could be shown that the Corporation were taking a kindly interest in the work of the Institution.

Another decision which has been come to by the Corporation is almost on all-fours with that of the Institution Fund. It is to the effect that, in view of the probability of the Gas Department promoting an exhibition of gas appliances towards the end of the year, they do not take space in the Scottish Exhibition, which is to be held in the city between May and October this year.

Notice of motion was given by Mr. M. W. Montgomery to the effect that, in view of the unsatisfactory lighting of private streets and courts, it be remitted to the Watching and Lighting Committee to consider what steps should be taken, under existing legislation or by further legislation, to secure improvement. Mr. Whitson gave notice of a motion to remit to the same Committee to consider whether any alteration (including power to the Corporation to levy an assessment for the lighting of stairs and closes) should be made in the existing provisions in the Glasgow Police Acts with reference to the lighting of private streets and courts and stairs and closes.

At a meeting of the Dunoon Town Council on Tuesday evening, it was agreed to purchase the works and connections of the Innellan Gaslight Company, Limited, at the price of £752. The intention is to supply gas from Dunoon at a similar price as at Sandbank, to the north of Dunoon—viz., 5s. per 1000 cubic feet. At present, the price at Innellan is 7s. 6d. The mains from Dunoon already extend for a considerable distance along the Innellan Road. The Innellan Gas Company was formed in 1893.

It is reported that, at a meeting of the Directors of the St. Andrews Gas Company held on Wednesday, sanction was given to an extension of the distributing plant, which is necessary on account of the increasing demand for gas for cooking and heating, as well as lighting. A system of automatic lighting and extinguishing of the street-lamps is in contemplation. An interim dividend for the half year at the rate of 7s. 6d. per share, free of income-tax, was intimated.

The annual meeting of the shareholders of the Larkhall Gas Company, Limited, was held on Friday of last week. The balance-sheet showed that the net available balance for appropriation was £1762. The Directors recommended a dividend of 10 per cent., absorbing £893; that £200 be placed to the reserve fund; and that the balance of £669 be carried forward. This was agreed to.

For some time there has been considerable expression of complaint at the quality of the water supplied to Edinburgh from the Talla works, and more especially since the installation of mechanical filters at Fairmilehead. Along with the process of mechanical filtration there is carried out the practice of treating the water with sulphate of alumina, and to this was attributed the reddish appearance which the water had, particularly when heated. The Town Council have obtained a report on the water from Mr. Thornton, who states that (1) The Talla gathering-ground is practically cut off from all sources of human pollution, and compares favourably with the finest gathering-grounds in the United Kingdom. (2) The Talla water, in his opinion, could be drunk with perfect safety antecedent to filtration. The filtration process is really only required to render the water clear, bright, and sparkling. (3) When the Talla water has been rendered slightly more alkaline (artificially or by mixing with other waters), it will, in his opinion, prove to be an ideal water for drinking purposes and for domestic use. (4) The water purification process adopted at Fairmilehead should not be blamed, because the effect of the use of sulphate of alumina is to slightly reduce the alkalinity of a water which, before filtration, is not sufficiently alkaline. The sulphate of alumina is, indeed, mainly responsible for effecting a reduction in the oxidizable organic matter and in the colour which could not, in his experience, be achieved by ordinary sand filtration. (5) There is not the slightest objection, on public health grounds, to the use of sulphate of alumina as a coagulant, or to the use of substances to increase the hardness or alkalinity of the Talla water, provided that such treatment is carried out under skilled supervision. (6) If the future of the Talla water is committed to the care of the experts advising the Water Trust, he predicts that the supply will soon become a source of pride to the citizens of Edinburgh. Mr. Thornton's report has not yet been laid before the Town Council.

The water brought to the Maryport reservoir by the newly-laid mains, and purified by the recently completed filter-beds, was formally turned on last Wednesday.

According to the report of the Directors of the Richmond Gas Stove and Meter Company, Limited, for the past year, the balance standing to the credit of profit and loss account (after deducting debenture interest) including £5030 brought forward, is £30,059. This the Directors recommend should be appropriated as follows: Depreciation on buildings, patterns, plant, show-rooms, fixtures, &c., £5434; dividend on preferred capital at the rate of 6 per cent. per annum (less income-tax), £5881; dividend (free of income-tax), at the rate of 10 per cent. per annum, £8161; reserve fund (bringing the amount up to £40,000), £5000; and leaving a balance to the next account, subject to the Directors' remuneration, of £5593. After placing the entire cost of advertising, as in former years, against revenue, the Directors recommend a dividend at the rate of 10 per cent. per annum.

Coming Events.

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The Cooker Season is now near at hand. If you wish to have the benefit of the best and most up-to-date Cookers—the "MAIN" Cookers—consult us before making your arrangements. With the confidence of experience we know that we can please you.

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CURRENT SALES OF GAS PRODUCTS.

[For Table of "Tar Products Prices," see p. 724.]

LIVERPOOL, *March* 4.

Sulphate of Ammonia.

There is frequently a pause at the end of one month and the commencement of another, but on this occasion such has not been the case; those dealers who have requirements to cover having evidently decided to proceed with their purchasing without delay. A fair amount of fresh inquiry for export has also come forward, and the demand for home consumption is, of course, increasing at this time of the year. Consequently, there has again been an active market all through the week, and a still further advance has been scored; the quotations at the close being £14 6s. 3d. to £14 7s. 6d. per ton f.o.b. Hull, £14 7s. 6d. to £14 8s. 9d. per ton f.o.b. Liverpool, and £14 8s. 9d. to £14 10s. per ton f.o.b. Leith. The forward position has become rather quiet; but makers maintain a very firm attitude, and are now asking £14 2s. 6d. per ton for April-June, and £13 15s. per ton for July-December delivery. So far, however, no business has transpired at these prices.

LONDON, *March* 6.

Tar Products.

There has been very little change in the markets for tar products during the past week. Pitch remains in about the same position, and there are not many fresh orders in the market. Benzols show some signs of weakening. Crude carbolic acid continues very firm.

The average values during the week were: Tar, 17s. 9d. to 21s. 9d., *ex* works. Pitch, London, 35s. 6d. to 36s.; east coast, 35s. 6d. to 36s. 6d.; west coast, Manchester, 35s. 6d. to 36s. 6d., Liverpool, 36s. to 36s. 6d., Clyde, 36s. to 37s. Benzol, 90 per cent., casks included, London, 9½d. to 10d.; North, 9d. to 9½d.; 50-90 per cent., casks included, London, 9½d. to 10d.; North, 9d. to 9½d. Toluol, casks included, London, 9⅞d.; North, 9½d. Crude naphtha, in bulk, London, 4d. to 4½d.; North, 3½d. to 3⅝d.; solvent naphtha, casks included, London, 11½d. to 1s.; North, 10½d. to 11d.; heavy naphtha, casks included, London, 11⅜d. to 1s. 0½d.; North, 10⅜d. to 11d. Creosote, in bulk, London, 2¼d. to 2⅜d.; North, 1⅞d. to 2d. Heavy oils, in bulk, 2⅜d. to 2⅝d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 8d. to 1s. 8½d.; west coast, 1s. 7d. to 1s. 7½d. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 45s., bags included. Anthracene, "A" quality, 1¼d. to 1½d. per unit, packages included and delivered.

Sulphate of Ammonia.

This market has remained firm, and in some quarters slightly improved prices have been paid; but the volume of business has not been so considerable. To-day actual Beckton is quoted £14. Outside London makes are £13 12s. 6d. to £13 15s. In Hull, £14 5s. is quoted; Liverpool, £14 6s. 3d. to £14 7s. 6d.; Leith, £14 5s. to £14 7s. 6d.; and Middlesbrough, £14 2s. 6d. to £14 5s.

COAL TRADE REPORTS.

Northern Coal Trade.

The coal trade of the North has been a good deal interfered with by the stormy weather, which has delayed steamers, and thus lessened the shipments; but the prospect is now better. In the steam coal trade, best Northumbrians are from 9s. 8d. to 10s. per ton f.o.b. For second-class steams, 8s. 6d. to 8s. 9d. is quoted; and for steam smalls from 4s. 9d. to 6s. 3d. is the current price. Work at the collieries is well maintained, except for delays such as that mentioned above. In gas coals, the price is steady on the whole. Durham kinds are from 8s. 6d. to 9s. 4d. per ton f.o.b. for the usual classes, according to quality; while for "Wear specials," up to 10s. 7½d. is quoted. The large contracts for the Berlin gas-works are now settled. The amount is about 700,000 tons, and fully half of this quantity is said to have been placed with Durham collieries and merchants, at prices which are reported to leave from 8s. 9d. to 9s. per ton f.o.b.; but this depends on what is allowed for freight, lighterage, &c. The exact price at Berlin is said to be from 14·25 to 14·90 marks; but the details of allotment are not to hand. Coke is steady. Gas coke is now less plentiful, and is quoted from 14s. to 14s. 3d. per ton f.o.b. for good quality.

Scotch Coal Trade.

The market has been quiet, shipping having been greatly interfered with by extremely stormy weather, which has had the effect of delaying sailings. The only good demand is for washed stuffs and dross for home consumption. The prices now quoted are: Ell, 9s. to 10s. per ton f.o.b. Glasgow; splint, 10s. to 10s. 3d.; and steam, 9s. 3d. to 9s. 6d. The shipments for the week amounted to 247,614 tons—a decrease of 44,086 tons upon the previous week, and of 51,765 tons upon the corresponding week last year. For the year to date, the total shipments have been 2,157,506 tons—a decrease upon the corresponding period of 37,902 tons.

Enfield Gas Company.—When moving, at the half-yearly meeting of the Enfield Gas Company, the adoption of the report referred to in last week's "JOURNAL" (p. 629), Colonel Sir A. P. Somerset, K.C.B., referred to the fact that the capital account was over-spent by more than £15,000; and he said that, as additional plant must be provided, the Board had arranged to offer another £10,000 of consolidated ordinary stock to tender. He also drew attention to the further reduction of 2d. per 1000 cubic feet in the price of gas, dating from Oct. 1 last. This was the third of such reductions made in the 3½ years immediately preceding that date; and they had amounted in all to 5d. per 1000 cubic feet. The report having been adopted and the dividends declared, the meeting was made special, and the shareholders present unanimously approved the Bill which the Company are promoting in Parliament. Votes of thanks to the Chairman and Directors and the General Manager and Secretary (Mr. C. W. Offord) and staff terminated the proceedings.

The Davis Gas Stove Co., Ltd., Luton.

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"Davis" Cookers gained the Highest Award, and were placed first in order of merit, at the two first important Gas Exhibitions ever held. We refer to the Smoke Abatement Exhibition, South Kensington, 1882, and the International Exhibition, Crystal Palace, 1883.

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Gas Supply at Cradley Heath.

The report presented to the shareholders of the Cradley Heath Gas Company at the recent annual meeting, and the remarks of the Chairman (Mr. Thomas Berridge, of Leamington) in moving its adoption, show that there was a profit of £3480 on the revenue account, and from this the debenture interest to the end of the year and the interim dividend had been paid; leaving £2352 to be dealt with. The Directors recommended the payment of a half-year's dividend at the rate of £11 5s. per cent. on the original shares, £7 17s. 6d. per cent. upon the ordinary shares, and 4 per cent. on the preference shares. The payment of these dividends would absorb £1024. It was proposed to place £319 to the insurance fund, and carry forward the balance, which would then amount to £4607. The quantity of gas sold in the past twelve months, compared with the previous year, showed the substantial increase of 8 million cubic feet, or 7·72 per cent., due partly to the improved state of trade and to the addition of new consumers. The Directors had decided to reduce the price of gas 2d. per 1000 cubic feet to ordinary consumers for lighting and 1d. per 1000 cubic feet for power purposes from the commencement of the year; making the highest price for lighting 2s. 6d. and for power 1s. 6d. Mr. Berridge characterized the working results last year as "first class;" no less than 11,724 cubic feet of gas per ton of coal carbonized having been reached. The net results were that the Company were able to pay their full maximum dividends and make a reduction in the price of gas. He called the attention of the shareholders to the greatly improved results which are now obtained from using gas under high pressure, and stated that the cost per hour for 1000-candle power is just under 6d., and therefore well able to compete with electricity at less than 1d. per unit. A cordial vote of thanks was passed to the Directors and to Mr. Charles Dakin, the Secretary and Manager, for the able manner in which they had carried out their duties during the past year.

Melbourne Metropolitan Gas Company.—The report of this Company for the half year ended Dec. 31 shows that the net profits, including £2306 brought forward, amount to £96,007. The Directors have transferred £24,500 to the reserve fund account, £3000 to the meter renewal fund, £20,000 to works reconstruction account, and £3000 to the gas-stoves, &c., account. They recommend a dividend at the rate of 5s. per share; leaving £2646 to be carried forward.

Grays and Tilbury Gas Company.—At the half-yearly meeting of this Company, the Chairman (Mr. F. E. Bartlett), in moving the adoption of the report, congratulated the shareholders upon the excellent results of the working in the second half of the past year, and drew attention to the further economies effected in labour, the better carbonizing results obtained, and the large reduction in the unaccounted-for gas. The quantity of gas sold showed an increase of 5·12 per cent., compared with the corresponding half of 1909. Dividends were declared at the rates of £8 and £5 12s. per cent. per annum (less income-tax) on the "A" and "B" shares respectively.

Price of Gas at Stockport.

At the last meeting of the Stockport Town Council, Mr. Brewster moved—"That from the end of the present financial year the price of gas be reduced to the ordinary consumers for lighting purposes 3d. per 1000 cubic feet, and that the price of gas to the automatic meter users be reduced by the same proportion." He mentioned that the price of gas was 2s. 6d. per 1000 cubic feet, less 2d. discount if paid by a certain period. In a list of 69 municipal gas undertakings, Stockport was very low down in the price charged. Last year the profit was £21,054; and the amount handed over to the rates was £18,000. What he proposed meant a reduction of one-tenth in the price charged; and this would still mean a profit of £18,948, and £18,000 could still be given in relief of the rates. In the discussion, Mr. Bell said that if Mr. Brewster's proposals were carried out it would mean a loss of profits of over £7000; and if they were deprived of between £7000 and £8000 out of the sum they now received from the Gas Department in aid of the rates, it would mean that they would have to increase the rates by 6d. in the pound. Alderman Fernley (Chairman of the Gas Committee) said the proposal would mean that £2000 would go to people in the outside districts who had to provide none of the capital. Mr. Hopkins suggested that if the Gas Committee could not agree to the reduction, they might agree to raise the price paid for gas for power purposes. Mr. J. Winter (Vice-Chairman of the Gas Committee) said it was undesirable to adopt this suggestion, because it was the large consumers of gas for power purposes who made it possible to sell the gas at the present low rates. Alderman Sharples contended that it was impossible, in view of anticipated expenditure at the works, to reduce the price of gas; while Alderman Allcock supported the motion, and said statistics showed that where gas was the cheapest the consumption was the greatest. The motion was lost by 34 votes to 22.

A lecture illustrated by an oxy-hydrogen lantern display was recently delivered by Mr. William Edgar before a meeting of the fitters of the Brentford Gas Company. The lantern slides showing the component parts of the various appliances the audience had to deal with in their daily work, were especially good; and as each was thrown upon the sheet Mr. Edgar clearly and fully explained them. In addition to the slides, the lecturer gave practical demonstrations of the best methods of fixing and cleaning the fittings, which made the lecture doubly instructive.

The report of John Wright and Eagle Range, Limited, sets forth that the balance of the revenue account for the past year, after augmenting the contingent reserve and charging Directors' fees, Managing-Directors' remuneration, and depreciation on the buildings and plant, amounts to £55,062. After adding the balance brought forward and deducting the interim dividends paid in August, there remains at disposal £46,760. The Directors recommend the payment of a dividend of 2s. 6d. per share on the ordinary shares (free of income-tax), that £8000 be placed to the reserve, and that £10,484 be carried forward.

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How to obtain hot water in an economical, simple and quick way has been the constant study of very able and interested men for years, but the difficulties of the problem have been apparent by the absence of really suitable apparatus, and whilst we do not claim to have achieved finality in this direction, we have, as already announced, entirely re-organized this department.

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And WARRINGTON.

Wandsworth and Putney Gas Company's Employees' Dinner.

The annual dinner of the employees of the Wandsworth and Putney Gas Company took place at the Wandsworth Baths on Saturday, the 25th ult. The hall was brilliantly illuminated; a special installation of nine lamps supplied with high-pressure gas, giving a light of about 13,500-candle power, having been put in for the occasion. The chair was occupied by Mr. H. O. Carr, the Engineer of the Company, who is the President of the annual dinner and sports; and he was supported by Mr. Charles W. Braine, the Company's Secretary, who is the Treasurer, and by Mr. E. C. Wells, the Secretary. The company numbered about 200. The Chairman proposed "Prosperity to the Wandsworth and Putney Gas Company." In doing so, he said he thought all present were much indebted to their head inspector (Mr. A. F. Ball) for the fine display of light he had given them. They could see what they were doing. It was very good of the Borough Council to permit them to dine under their own light, instead of having to dine under one for which they had no sympathy. They had been dining, more or less, under high pressure; and it had given them an opportunity of displaying their light, instead of hiding it under a bushel. Gas companies at the present day were being attacked most vigorously, and, he thought, rather spitefully, possibly due to envy by the conductors of all electric light undertakings. It was said that they poisoned the air. He was bound to say that the contrary was the case. Gas lighting did take away a certain amount of air; but at the same time it brought air in, and this ventilated any room in which gas was used. They all knew how harmful germs were. They propagated very quickly, and were very busy in a room that was electrically lighted. The lighting did not tend in any way to destroy the germs given off by human beings in an ill-ventilated room, but, he thought, helped to multiply them. In the case of a room where there were gas-burners, on the other hand, the germs were taken through the burner and utterly destroyed. Another point he should like to emphasize was with regard to electric heating and gas heating. When there was a gas-fire in the room, it promoted ventilation by drawing in fresh air in the same way as a coal fire; but in the case of electric radiators, this was not the same. The air was circulated to a very small extent, and it made the atmosphere of a room somewhat stuffy. Turning to the affairs of the Company, Mr. Carr referred to the recent reduction in price—making it 1s. 9d. per 1000 cubic feet. He said he believed he was right in stating that, with the exception of three gas undertakings, the Wandsworth and Putney Company supplied the lowest-priced gas. The places alluded to were Plymouth, Sheffield, and Widnes. The low price of gas used for power (1s. 6d. per 1000 cubic feet) had led to its increased use; the quantity employed last year being 7 per cent. of the total, compared with 5 per cent. in 1909. The reduction of 1d. had put ½ per cent. on the profit-sharing; and the men were getting 7 per cent. on their wages, which was not at all bad. The Company, with the help of Mr. Braine, did not forget to advertise, which was a great thing for any company; and he thought that so long as they had such good Directors, staff, and workmen, the prosperity of the Company would never be questioned. In responding to the toast, Mr. Braine said the reduction in price of which Mr. Carr had spoken was really a wonderful thing, for it saved the pockets of the consumers practically £4000 a year. The shareholders also benefited, but only to the extent of about £400. All the men who were going in for the profit-sharing would benefit to a great extent. The old rate of 6½ per cent. had been increased to 7 per cent. The better the men worked, and the greater interest they took in the Company, the more likelihood there was of the price of gas being further reduced, and the profit-sharing percentage increased. Among the subsequent toasts was "The Chairman," which was proposed by Mr. J. Hancock. Mr. Carr, in returning thanks, said that without the assistance of the staff and men he would be nowhere. It was by combining that the success of the Company was brought about. The proceedings were very enjoyable; various vocal and instrumental pieces being given during the evening.

Slot-Meters in Cork.—When addressing the shareholders at the recent half-yearly meeting of the Cork Gas Consumers' Company, the Chairman (Mr. George Lynch) stated that the consumers continued to increase—to a small extent in the number having ordinary meters, and to a large one in the case of those using slot-meters; 330 of the latter class having come upon the books since this time last year. The slots now numbered about the same as the ordinary meters. It was a gratifying feature about this increase in the slot-meters that it indicated that the convenience and economy of gas were being extended to a larger number of people occupying the smaller class of houses. The accounts presented showed a balance of £5673; and a dividend at the rate of 8 per cent. per annum was declared for the half year.

Weymouth Consumers' Gas Company.—At the recent half-yearly meeting of this Company, the Directors reported an increase of 2·24 per cent. in the quantity of gas sold during the six months ended Dec. 31; the output accounted for in that period being 67,224,900 cubic feet, which was in excess of that of the corresponding half of the previous year by 1,476,300 cubic feet. The sale of gas during the year 1910 was 125,424,700 cubic feet—an increase of 2,748,400 cubic feet over the year 1909. The profit on the revenue account was £2303; and the amount available for distribution was £4538. The Directors recommended the declaration of a dividend for the half year on the ordinary stock at the maximum rate of 5 per cent. per annum (less income-tax). In moving the adoption of the report, the Chairman (Mr. J. G. Rowe) remarked that, looking back over the last 3½ years, it would be of great interest to the shareholders to note that an increased output of no less than 15 million cubic feet of gas had been reached. The works had been repaired and maintained, and additions made to meet the growing demands upon them; and they had been brought up to the highest standard for the purpose of the undertaking. Mr. S. J. Fowler, in seconding the motion, pointed out that since the introduction of electric lighting into the town the annual output of gas had increased by 26½ million cubic feet. The report was adopted. Thanks were accorded to the Chairman and Directors, for their able conduct of the Company's affairs; also to the Engineer and Manager (Mr. D. F. Colson), the Secretary (Mr. E. Y. Wood), and the members of the staff, for the efficient way they had discharged their duties.

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Coalexld.—There has just been held an exhibition at Clitheroe of "Coalexld" fires, both in sitting-room grates and anthracite stoves, to demonstrate to the public the advantages of this fuel. The exhibition was a huge success; and we learn that there has been a great demand at the gas-works for the fuel. It is stated that the demand for the Coalexld process is growing both at home and abroad, and that, considering the short time which has elapsed since the date of the patents, the headway made has been marvellous.

Croydon Water Supply.—The latest addition to the water-works of the Croydon Corporation—a pumping-station at Waddon, which with plant has cost about £30,000, was formally opened last week by Alderman King, the Chairman of the Water Committee. The site of the new well comprises 6 acres off Coldharbour Lane; and the work has taken two-and-a-half years to carry out. The well is 8 feet diameter, and is sunk 190 feet in chalk. The Corporation are authorized to take from the site a quantity of water not exceeding 50 million gallons in 30 days.

Normanton Gas Supply.—Though during the past half year they had sold 1,760,000 cubic feet more gas than in the corresponding period of 1909, said Mr. J. Armitage, the Chairman of the Normanton Gas Company, at the recent meeting, the consumption of coal had been less by 68 tons. The report stated that the profits for the six months to Dec. 31 amounted to £2118. The fund available for distribution was £4322, out of which dividends of 6 per cent. on the original stock and 4½ per cent. on the additional stock were recommended, as well as the allocation of £300 to the reserve fund. The report was adopted, and the Chairman, Directors, Secretary and Manager (Mr. E. H. Hudson), and the staff were thanked for their services.

Crediton Gas Company.—Mr. W. A. Schultz presided at the annual meeting of this Company, which was held in London last Tuesday. In moving the adoption of the report, he referred to the works, which he said were now in good order. The price of gas had been reduced 2d. per 1000 cubic feet during the year. He was pleased to report that, under the management of Mr. Corrigen, the unaccounted-for gas had been reduced from 13 to less than 7 per cent. The accounts accompanying the report showed that 10,167,000 cubic feet of gas had been made, which worked out at 11,100 cubic feet per ton of coal carbonized. The sale of coke was 10 cwt. per ton of coal. The net profit was £1030; and after paying 5 per cent. on the preference shares, a dividend of 7½ per cent. on the original shares and of 5¼ per cent. on the additional ordinary shares was declared.

Salford Gas-Charges.—At a meeting of the Salford Town Council last Wednesday, the Lighting Committee submitted a supplementary estimate of £1843. In proposing its adoption, Alderman Hulton stated that the Committee had reduced the original estimate for the year by £2000 on the distinct understanding that their gas bill would be less by this amount; but, the Council having altered their whole attitude in regard to gas-charges, his Committee would not benefit to the extent promised. He did not claim sympathy in this matter, but was inclined to lay the blame on the shoulders of the Gas Committee. Mr. Purcell said the whole object of the Council seemed to be to keep down the rates by the adoption of what he described as a mistaken policy, under which the poorest were always the greatest sufferers. It had been expected, in this particular case, to get off with £1150 less than the original estimate at the expense of the poor users of gas by prepayment meters; but he was glad to say this expectation had not been realized. The supplementary estimate was agreed to.

Prosperity and Profit-Sharing at Watford.—At the half-yearly meeting of the Watford Gas Company, the Directors reported that the receipts from the sale of gas and residual products had again been most satisfactory; and that the works and plant were, as usual, in first-class order. The revenue account showed a profit of £4978; and on the profit and loss account there was a balance of £7385 available for the payment of the half-year's dividends. When the price of gas was last reduced, full advantage was not taken of the sliding-scale to declare the statutory dividends. The Directors therefore recommended that these should be increased by 2s. 6d. and be declared as follows: On the "A" stock at the rate of £7 7s. 6d. per cent. per annum, and on the "B" stock at the rate of £5 17s. 6d. per cent. per annum, both less income-tax. The Chairman (Mr. W. T. Coles), in the course of his remarks when moving the adoption of the report, referred to the Company's co-partnership scheme, which had cost them £256. He said there was no doubt about its success. With the exception of the men who happened to have left the Company, not a single man had fallen out; and many of the men were shareholders in the concern. This must give them greater interest in their work. At a later stage of the proceedings, in responding to a vote of thanks to the Directors, the Chairman proposed a similar vote to the staff, who, he said, from the highest to the lowest, worked harmoniously for the welfare of the Company.

Bideford Water Supply.—Mr. Baldwin Latham has made a report to the Bideford Town Council on the subject of the water supply and his suggestions for improving it. He reviews the position since 1865, when he was first consulted by the Corporation, and points out that at the time only part of the proposed drainage area at Gammaton was taken in. The diminution of pressure now experienced in many parts of the town is due, he thinks, to the obstructed state of the mains, which have become corroded after being laid for upwards of thirty years; and he recommends that immediate steps should be taken for boring out all the mains in the district. Another reason for deficiency of pressure is the large number of dead-ends. There are no fewer than 45 of these; and Mr. Latham recommends that wherever possible these should be connected-up. He points out that the pressure of water in the mains supplying the low-level district can be utilized to raise a portion of the water sufficient for the high-level area. A considerably increased drainage area is required to give a sufficient supply to the town; and this, as well as additional storage, might be procured both on the east and west of the present area, as was originally proposed in the scheme. No estimate had been made of the cost of the works; but Mr. Latham added that he believed it would be much the cheapest scheme the Council could adopt both for supplying abundance of water and for increasing the pressure and providing for the distribution of water at an increased altitude. By the scheme none of the existing works would be abandoned.

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Wolverhampton Gas Company.—Dividends were declared at the annual meeting of the Wolverhampton Gas Company at the rate of 3 per cent. upon the preference stock, 5⅛ per cent. upon the consolidated stock, and 3½ per cent. upon the ordinary stock, less income-tax; and it was decided to carry the balance of the excess dividend undivided (£459) to the reserve fund. A sum of £9062 is carried forward to the next account. The Engineer and Manager (Mr. Percy G. Winstanley) stated that the increase during the year in slot-meters had been very remarkable—namely, 826, or 8 per cent. In the ordinary cookers sold, they had an increase of 6½ per cent., and an increase of slot-cookers of 10 per cent. The additional length of main laid was 1117 yards; and the net increase in the sale of gas was 15 million cubic feet.

Rugby Gas Company.—The report which was adopted at the annual meeting of the Rugby Gas Company stated that the receipts for the year ended Dec. 31 amounted £25,424, and the expenditure to £18,781; leaving a balance of £6643 to be carried to the profit and loss account. The net balance, after deducting dividends, was £13,822. Owing to the depreciation in the value of the investments in Consols and Birmingham Corporation stock, the Directors proposed to write off this loss, and to invest the amount necessary to restore the balance on the insurance and reserve funds. The Board recommended a dividend for the half year on the original share capital at the rate of 14½ per cent. per annum, amounting to £2560, and a dividend on the additional capital issued of 11½ per cent. per annum, amounting to £303.

Sales of Stocks and Shares.—At the Mart, Tokenhouse Yard, E.C., last Tuesday, Messrs. A. & W. Richards offered for sale, under instructions from Directors, new issues of preference and ordinary shares in the South-West Suburban and Southend Water Companies. The first-named Company had for disposal 500 £10 preference shares, bearing 5 per cent. dividend as from the 1st prox.; and they were all sold at from £13 to £13 2s. 6d. each. The Southend Company offered a like number of £10 new ordinary 5 per cent. maximum shares, ranking with the Company's existing similar shares, on which 4½ per cent. was paid for the past year; and they fetched £10 5s. to £10 10s. apiece. Messrs. C. E. Williams and Co. sold on the same day some fully-paid £10 shares in the Oswestry Gas Company at £21 10s., £21 15s., and £21 17s. 6d. each.

Tonbridge Gas Company.—The shareholders were informed by the Chairman (Mr. W. Judd) at the annual meeting of the Tonbridge Gas Company that the working results had been most satisfactory; 11,350 cubic feet of gas having been obtained, and 11¼ cwt. of coke sold, per ton of coal carbonized. When two years ago the price of gas was reduced to 2s. 6d. per 1000 cubic feet, he thought the lowest point had been reached; but, without committing the Board in any way, he might say that they contemplated taking into consideration the question of a further reduction. The Engineer and Secretary (Mr. J. Donaldson), replying to a vote of thanks to himself and the employees, referred to the cordial relations existing between the management and the staff; and he added that he hoped to see the price of gas considerably lower than at present.

Elland-cum-Greetland Gas Supply.—In moving the adoption of the report at the recent annual meeting of the Elland-cum-Greetland Gas Company, the Chairman (Rev. G. E. Aspinall, J.P.) said the sale of gas last year constituted a record; the increase being 3,170,400 cubic feet, or 2·63 per cent. This was the more satisfactory as it was apparent in all departments. The income from sales of gas was higher by £832. The balance carried to the profit and loss account was £7147, against £6461 last year; being an increase of £686. There remained a total disposable balance of £9113, which was a record. If the dividend the Directors recommended (the statutory one) was authorized, there would be a balance to carry forward of £2361, against £1586 last year. As to the future, he thought the prospects of the Company were distinctly encouraging. The report was adopted.

Another Electric Light Failure at Southend.—A partial failure of the electric light at Southend on the night of Friday the 24th ult. occasioned a good deal of inconvenience. It happened about half-past seven, when the streets were filled with people, and the shops fairly busy. Fortunately, however, only a part of the town was affected. The first intimation the public had that something was wrong was a partial extinction of some of the arc lamps in certain streets, and in about a minute the light was entirely gone; while the supply at the hotels and many business establishments was so small as to be practically useless for illuminating purposes. In certain cases the best had to be made of what light there was; for some tradesmen, placing too much reliance on the electric current, had discarded the gas supply. It was not until half-past ten that the light was fully restored.

Leeds Revised Water Charges.—The following resolution dealing with modifications of the water charges has been adopted by the Leeds City Council: "That on and after June 30, 1911, the charges for the supply of water by meter in the city of Leeds be 10d. per 1000 gallons up to 400,000 gallons per quarter, 9d. per 1000 gallons from 400,000 gallons up to 800,000 gallons per quarter, 8d. per 1000 gallons from 800,000 gallons up to 1,200,000 gallons per quarter, 7d. per 1000 gallons over and above 1,200,000 gallons per quarter; the minimum charge for supply by meter, 10s. per quarter; and that the scale of charges for the supply of water by meter within the city of Leeds, passed at a meeting of the City Council held on Sept. 7, 1910, be varied accordingly." It was pointed out that the original proposal in the new scale was that the price should range from 8½d. to 9½d. per 1000 gallons; but they had found that these charges would fall unjustly on some of the very largest consumers. Under the modified scale, all the users by meter would pay the same up to a certain stage; and for successive quantities above that, they would pay less for the excess over each stage. A deputation representing six of the largest commercial concerns had met the Committee; and it was shown that in one case alone the increased water charges would amount to £600 a year. The new proposal would not affect the financial arrangements of the city for the next ten years. They received from some large consumers something like £70,000 a year; and they had been threatened by them that if the charges now made for water were not modified, they would provide their own supply.

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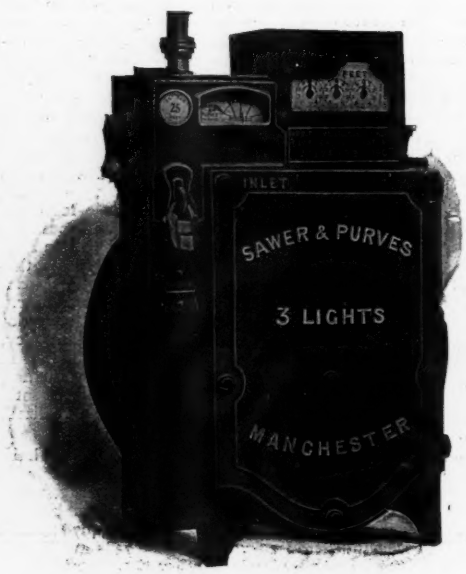

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The Salford Corporation have agreed to negotiate with the Irlam District Council for the sale of the Corporation's rights to supply gas in the Council's district.

The Lilleshall Company, Limited, of Oakengates, Shropshire, have received an order for a compound condensing beam pumping-engine and pumps for the Westgate and Birchington Water Company; for whom Messrs. W. A. Valon and Son, of Westminster, are Consulting Engineers.

Another large order has been received by Mr. A. Landsberger from the Imperial Continental Gas Association for 2050 "Meteor" controllers to be fitted to the street-lamps in Hanover. This order, when completed, will bring the total number of "Meteor" appliances to over 4000 in the city.

The Directors of Stewarts and Lloyd's, Limited, recommend dividends for the half year to Dec. 31 last at the rate of 6 per cent. on the preference shares, of 10 per cent. on the preferred ordinary shares, also of 1s. per share for the year on the deferred shares; further, that £70,000 be allowed for depreciation, £32,155 be placed to reserve fund, and £83,000 be carried forward.

A conference of the representatives of Messrs. Thomas Glover and Co., Limited, and Messrs. R. & A. Main, Limited, was held at Gothic Works, Edmonton, last Tuesday, when new models of cookers, &c., for the coming season were inspected and approved. In the evening, the Directors entertained the representatives, of whom thirty were present, at dinner at the Great Eastern Hotel.

Under the title of "Water Softeners, Limited," a Company has been formed with a capital of £200,000, in £1 shares, to acquire, work, grant licences in respect of, and otherwise turn to account patents, rights, and processes for the treatment of water for industrial and domestic uses, for the prevention of scale in boilers, and for other purposes, and to adopt an agreement with the Luminator Water Company, Limited.

Negotiations which have been proceeding between the Manchester and Salford Corporations as to an overcharge for water supplied, owing to a defective meter, are practically concluded, and to the satisfaction of both parties. Salford gets its water supply from Manchester; and it was alleged by the Water Committee of the Salford Corporation that they had been overcharged some £2000, owing to the faulty registering of one of the large meters through which the borough is supplied.

At a meeting of the Belfast Citizens' Association, Councillor Riddell spoke at length in favour of the Twin Island site for the erection of new gas-works. In conclusion, he remarked that he was afraid all they could do now was to arouse public opinion. He had offered to submit his figures to a jury of experts and prove that they were correct; while at the same time he undertook to show that the figures of his opponents were all wrong. If he had failed to do so, he would give £50 to the Royal Victoria Hospital. This offer, which was still open, had not been accepted.

The minutes of the Leeds Water Committee submitted at last week's meeting of the City Council contained a resolution empowering the Engineer to consult with Mr. Henry Rofe and Mr. James Watson, of Bradford, as to the foundation of the embankment of the Leighton reservoir. Mr. Willey, in moving the adoption of the minutes, explained that a large quantity of "Bible clay" had been found; and there was a possibility that, if no remedial steps were taken, the embankment might give way. Two measures were open to them. One was to remove the clay at a cost of £20,000 or £30,000, and the other to build four or five concrete piers in the clay at a cost of £6000 or £7000. They desired a consultation as to which would be the better method to adopt.

APPLICATIONS FOR LETTERS PATENT.

4206.—Banks, H., "Gas-purifier slide-valve." Feb. 20.
4213.—Clemmons, T., "Incandescent burners." Feb. 20.
4221.—Seddon, E. H. & A., "Bunsen burners." Feb. 20.
4260.—Priestman, A., "Controlling the flow of liquids." Feb. 20.
4280.—Sackett, J., "Treatment of cokes." Feb. 20.
4281.—Sackett, J., "Production of ammonium compounds." Feb. 20.
4288.—Slatter, F. V., "Petrol-gas manufacture." Feb. 20.
4316.—Thiem, W., "Remote-controlled electric gas-igniter." Feb. 20.
4356.—Lauder, A. C., "Securing shades." Feb. 21.
4383.—Wulf, C. A., "Direct-pressure valve." Feb. 21.
4427.—Armstrong, J., "Manufacture of coke and gas and bye-products." Feb. 22.
4489.—Imray, O., "Removing nebular particles from gases." A communication from A. Spiegel. Feb. 22.
4556.—Smith, F. G., and Atkinson, J. S., "Gas-producers." Feb. 23.
4569.—Wilson, W. A., "Gas-stove burners." Feb. 23.
4576.—Harff, L. P. J., "Operating gas-taps from a distance." Feb. 23.
4589.—Radcliffe, J., "Treatment of distillation residues." Feb. 23.
4629.—Perman, E. P., "Instruments for detecting when air contaminated by gas becomes explosive." Feb. 23.
4680.—Schwarz, P., "Distilling ammoniacal liquors." Feb. 24.
4688.—Sachse, A. P., "Gas lighting and extinguishing." Feb. 24.
4693.—Emms, W. J., "Gas-heater for hot-water systems." Feb. 24.
4708.—Cuss, C. T., "Incandescent gas lighting and heating." Feb. 24.
4753.—Fletcher, Russell, and Co., Ltd., and Fletcher, T. W., "Gas-heated blast-furnaces." Feb. 25.
4758.—Duff, A. B., and the Gas Power and Bye-Products Co., Limited, "Blower for ammonia-recovery gas-producers." Feb. 25.
4761.—Maggiora, D., "Gas-producing apparatus." Feb. 25.
4819.—Simpson, W. P., "Separation of water from tar." Feb. 25.

Application for Restoration of Lapsed Patent.

Carl Reiss has made application for the restoration of the patent granted to him for "Improvements in and relating to regulating gas-nozzles," No. 23,554, bearing date Oct. 23, 1906.

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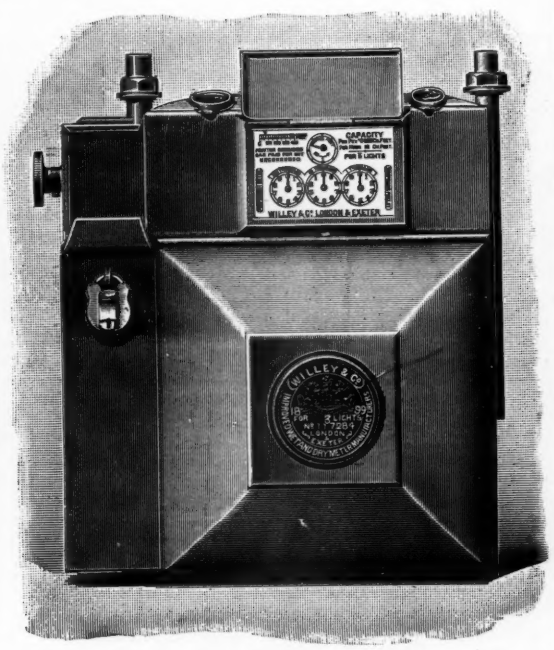

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					Liverpool.	Manchester.	
Tar crude	per ton	22/–	19/6 22/6	19/– 22/6	19/– 22/–	19/6 22/–	—
Pitch	,,	37/– 37/6	36/6 37/–	36/6	37/6	36/6 37/–	36/– 37/–
Benzol, 90%	per gallon	–/11	–/9½	–/9	–/8½	–/9	–/10
Benzol, 50-90%	,,	—	–/10	–/9⅜	–/8½	–/9	—
Toluol, 90%	,,	–/10½	–/9⅝	–/10	–/10	–/10	–/10
Crude naphtha, 30%	,,	—	–/3¾	–/3⅝	–/3¾	–/3¾ –/4	—
Light oil, 50%	,,	—	–/3⅜	–/3¾ –/4	–/3½	–/3¾	—
Solvent naphtha, 90-160	,,	1/–	–/10½ –/11	–/10	–/10½	–/11	–/11
Heavy naphtha, 90-190	,,	—	–/11	–/11½	–/11 –/11¼	–/11½	–/11
Creosote in bulk	,,	–/2⅛ –/2⅝	–/2 –/2¼	–/2	–/2¼	–/2⅝	–/1⅞
Heavy oils	,,	—	–/2⅛ –/3	–/2¼	–/2⅜	–/2⅛	–/3
Carbolic Acid, 60's	,,	—	1/8 1/9	1/9	1/8	1/8	1/7
Naphthalene, crude drained salts	per ton	—	42/6 45/–	40/– 42/6	45/– 47/6	47/6	—
,, pressed	,,	—	60/–	63/–	60/–	66/3	—
,, whizzed	,,	—	—	—	65/– 72/6	70/–	65/–
Anthracene	per unit	–/2	–/1⅜	–/1½	–/1¼	–/1¼	—

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

SECRETARY AND MANAGER. Tonbridge Water Company. Application by March 22.
MANAGER. Skibbereen Gas Company.
WORKING MANAGER (HAMPSHIRE). Applications to W. A. Schultz and Co., Cannon Street, E.C.
CLERK AND COLLECTOR. Sleaford Gas-Works.
ASSISTANT. Tawe Valley Gas Company.
GENERAL FOREMAN. Denbigh Gas and Water Companies. Applications by March 9.
FOREMAN. Box 2484, Burton's, Strand, W.C.
SALESMEN (COAL). No. 5358.

Situations, &c., Wanted.

AGENT OR SECRETARY. No. 5356.
SULPHATE PLANT REPAIRER, &c. Davies, Shepherd's Bush.
MANAGER OR SUPERINTENDENT OF COMMERCIAL DEPARTMENT. G., 35, Burchell's Advertising Offices, Liverpool.

Plant, &c. (Second-Hand), For Sale.

CONDENSERS, EXHAUSTERS, AND TAR-EXTRACTORS. Box 2486, Burton's, Strand, W.C.
ENGINE AND EXHAUSTER. South Bank Gas-Works.
EXHAUSTER AND WASHER. Yeovil Gas-Works.
EXHAUSTERS, &c. Cardiff Gas Company.
STATION METER. Oldbury Gas Department.

Plant, &c. (Second-Hand), Wanted.

PURIFIERS. Madeley Gas-Works.

Meeting.

SOUTH METROPOLITAN GAS COMPANY. De Keyser's Hotel. March 23. Twelve o'clock.

Stocks and Shares.

CARDIFF GASLIGHT AND COKE COMPANY, March 14.
DARTFORD GAS COMPANY. March 14.
HARROW AND STANMORE GAS COMPANY. March 14.
LOWESTOFT WATER AND GAS COMPANY. March 14.
TENDRING HUNDRED WATER COMPANY. March 14.
UXBRIDGE GAS COMPANY. March 28.

TENDERS FOR

Coal.

DARLINGTON GAS DEPARTMENT. Tenders by March 22.
FORFAR GAS DEPARTMENT. Tenders by March 10.

Coke.

WANDSWORTH AND PUTNEY GAS COMPANY. Tenders by March 17.

Cookers.

PONTYPRIDD GAS DEPARTMENT. Tenders by March 14.

Fire-Clay Goods.

PONTYPRIDD GAS DEPARTMENT. Tenders by March 14.
TIPTON GAS DEPARTMENT. Tenders by March 11.

General Stores (Benzol, Sulphuric Acid, Drysaltery, Lead and Compo. Tubing, Barrows, Rakes, Shovels, Forks, Oils, Paints, Main Taps, Locks, Iron and Steel, Copper, Ironmongery, Brass and Meter Fittings, &c.)

DARLINGTON GAS DEPARTMENT. Tenders by March 22.
PONTYPRIDD GAS DEPARTMENT. Tenders by March 14.

Incandescent Materials, Lamps, and Slot Fittings.

PONTYPRIDD GAS DEPARTMENT. Tenders by March 14.

Meters.

PONTYPRIDD GAS DEPARTMENT. Tenders by March 14.

Pipes, &c.

ASH-NEXT-SANDWICH GAS COMPANY. Tenders by March 25.
DARLINGTON GAS DEPARTMENT. Tenders by March 22.
PAIGNTON GAS COMPANY. Tenders by March 18.
PONTYPRIDD GAS DEPARTMENT. Tenders by March 14.

Tar.

PADIHAM GAS DEPARTMENT. Tenders by March 15.
PONTYPRIDD GAS DEPARTMENT. Tenders by March 14.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 664.

Issue.	Share.	When ex-Dividend.	Dividend or Interest and Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.	Issue.	Share.	When ex-Dividend.	Dividend or Dividend and Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.	£			p.c.				£ s. d.
1,551,868	Stk.	Oct. 14	5	Alliance & Dublin Ord.	81—84	..	5 19 1	4,940,000	Stk.	Nov. 11	9	Imperial Continental .	188—190	+1½	4 14 9
374,000	Stk.	Jan. 13	4	Do. 4 p.c. Deb.	96—98	+2	4 1 8	1,235,000	Stk.	Feb. 10	3½	Do. 3½ p.c. Deb. Red.	92—94	..	3 14 6
200,000	5	Oct. 28	7	Bombay, Ltd. . . .	6¼—7	..	5 0 0	200,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c. .	122—124	..	4 16 9
40,000	5	,,	7	Do. New, £4 paid .	5—5½	..	5 1 10	561,000	Stk.	Feb. 24	10	Liverpool United A. .	215—217*	..	4 12 2
50,000	10	Feb. 24	15	Bourne-) 10 p.c. .	28—29*	..	5 3 5	718,100	,,	,,	7	Do. B. .	161½—163¼*	..	4 5 8
311,810	10	,,	7	mouth Gas) B 7 p.c. .	16—16¼*	..	4 4 10	306,083	,,	Dec. 30	4	Do. Deb. Stk.	102—104	..	3 16 11
75,000	10	,,	6	and Water) Pref. 6 p.c.	14¼—15*	..	4 0 0	75,000	5	Dec. 15	6	Malta & Mediterranean	4⅜—5	..	6 0 0
380,000	Stk.	,,	12½	Brentford Consolidated	251—254*	..	4 18 5	560,000	100	Oct. 1	5	Met. of) 5 p.c. Deb.	102—104	..	4 16 2
330,000	,,	,,	9½	Do. New . . .	196—199*	..	4 15 6	250,000	100	,,	4½	Melbourne) 4½ p.c. Deb.	102—104	..	4 6 7
50,000	,,	,,	5	Do. 5 p.c. Pref. .	118—120*	..	4 3 4	541,920	20	Nov. 11	3½	Monte Video, Ltd. . .	12⅜—13½	..	5 5 8
206,250	,,	Dec. 15	4	Do. 4 p.c. Deb. .	98—100	..	4 0 0	1,775,892	Stk.	Feb. 24	4½	Newc'tle&G'tesh'd Con.	99½—100¾*	..	4 7 1
220,000	Stk.	Aug. 31	11	Brighton & Hove Orig.	220—223	..	4 18 8	529,705	Stk.	Dec. 30	3½	Do. 3½ p.c. Deb.	89—90	..	3 17 9
246,320	,,	,,	8	Do. A Ord. Stk. .	159—162	..	4 18 9	55,940	10	Aug. 31	7	North Middlesex 7 p.c.	14—15	+½	4 13 4
460,000	30	Sept. 29	10⅝	British	44¼—45½	..	4 13 6	300,000	Stk.	Nov. 30	8	Oriental, Ltd. . . .	139—141	..	5 13 6
109,000	Stk.	Feb. 10	6	Bromley, A 5 p.c. . .	116—118	..	5 1 8	60,000	5	Sept. 15	8	Ottoman, Ltd. . . .	6⅜—7½	..	5 10 4
165,700	,,	,,	4½	Do. B 3½ p.c. . .	87—89	..	5 1 2	31,800	53	Feb. 24	13	Portsea Island A . . .	130—132*	..	5 3 8
82,278	,,	,,	5½	Do. C 5 p.c. . .	106—108	..	5 1 10	60,000	50	,,	13	Do. B . . .	123—125*	..	5 4 0
55,000	,,	Dec. 30	3½	Do. 3½ p.c. Deb. .	84—86	..	4 1 5	100,000	50	,,	12	Do. C . . .	116—118*	..	5 1 8
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	96—98	+1	4 1 8	114,800	50	,,	10	Do. D and E.	101—103*	..	4 17 1
100,000	10	—	—	Cape Town & Dis., Ltd.	3¾—4½	..	—	398,490	5	Oct. 28	7	Primitiva Ord. . . .	7⅛—7⅝	–⅛	4 8 2
100,000	10	—	—	Do. 4½ p.c. Pref. .	6—6½	..	—	796,980	5	Dec. 30	5	Do. 5 p.c. Pref. .	5¼—5½	..	4 10 11
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	—	..	—	488,900	100	Dec. 1	4	Do. 4 p.c. Deb. .	96—98	+1	4 1 8
100,000	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.	88—90	..	5 0 0	312,650	Stk.	Dec. 30	4	River Plate 4 p.c. Deb.	96—98	+1	4 1 8
157,150	Stk.	Feb. 24	5	Chester 5 p.c. Ord. . .	107—109*	..	4 11 9	250,000	10	Sept. 29	9	San Paulo, Ltd. . . .	15⅛—16	..	5 12 6
1,513,280	Stk.	,,	5/9/4	Commercial 4 p.c. Stk.	111—114*	..	4 15 10	115,000	10	,,	6	Do. 6 p.c. Pref. .	11⅝—12¼	..	4 18 0
560,000	,,	,,	5½	Do. 3½ p.c. do..	107—109*	..	4 17 10	125,000	50	Jan. 3	5	Do. 5 p.c. Deb. .	50—51	..	4 18 0
475,000	,,	Dec. 15	3	Do. 3 p.c. Deb. Stk.	77—79	..	3 15 11	135,000	Stk.	Aug. 31	10	Sheffield A	235—237	+1	4 4 5
800,000	Stk.	,,	4	Continental Union, Ltd.	95—97	..	4 2 6	209,984	,,	,,	10	Do. B	235—237	+1	4 4 5
200,000	,,	,,	7	Do. 7 p.c. Pref.	136—138	..	5 1 5	523,500	,,	,,	10	Do. C	235—237	+2	4 4 5
492,270	Stk.	—	5½	Derby Con. Stk. . . .	122—124	..	4 8 9	70,000	10	Oct. 14	6	South African . . .	10½—11	..	5 9 1
55,000	,,	—	4	Do. Deb. Stk. . . .	104—105	..	3 16 2	6,429,895	Stk.	Feb. 10	5/9/4	South Met., 4 p.c. Ord.	119—121	..	4 10 3
148,995	,,	Oct. 14	5	East Hull 5 p.c. Ord. .	103—105	..	4 15 3	1,895,445	,,	Jan. 13	3	Do. 3 p.c. Deb.	79—81	..	3 14 1
486,090	10	Jan. 27	12	European, Ltd. . . .	26—27	..	4 8 11	209,820	Stk.	Aug. 31	8	South Shields Con. Stk.	156—158	..	5 1 3
354,060	10	,,	12	Do. £7 10s. paid.	19½—20½	..	4 7 10	605,000	Stk.	Feb. 24	5⅔	S'th Suburb'n Ord. 5 p.c.	117½—119½*	..	4 14 9
16,179,445	Stk.	Feb. 24	4⅜	Gas-) 4 p.c. Ord. . .	105½—106½*	+¼	4 7 7	60,000	,,	,,	5	Do. 5 p.c. Pref. .	118—120*	..	4 3 4
2,600,000	,,	,,	3½	light) 3½ p.c. max. .	85—87*	..	4 0 6	117,058	,,	Jan. 13	5	Do. 5 p.c. Deb. Stk.	122—124	..	4 0 8
4,062,235	,,	,,	4	and) 4 p.c. Con. Pref.	101—103*	..	3 17 8	502,310	Stk.	Nov. 11	5	Southampton Ord. . .	111—113	..	4 8 6
4,531,705	,,	Dec. 15	3	Coke) 3 p.c. Con. Deb.	79—81	..	3 14 1	120,000	Stk.	Feb. 10	7	Tottenham) A 5 p.c. .	141—143	..	4 17 11
258,740	Stk.	Sept. 15	5	Hastings & St. L. 3½ p.c.	94—96	..	5 4 2	483,940	,,	,,	5½	and) B 3½ p.c. .	115—117	..	4 14 0
82,500	,,	,,	6½	Do. do. 5 p.c.	114—116	..	5 12 1	149,470	,,	Dec. 15	4	Edmonton) 4 p.c. Deb.	98—100	..	4 0 0
70,000	10	Oct. 14	11	Hongkong & China, Ltd.	17½—17⅞	..	6 4 0	182,380	10	Dec. 30	8	Tuscan, Ltd.	9—9½	..	8 8 6
131,000	Stk.	Sept. 15	7⅜	Ilford A and C . . .	147—150	..	4 18 4	149,900	10	Jan. 3	5	Do. 5 p.c. Deb. Red.	98—100	..	5 0 0
65,780	,,	,,	5⅛	Do. B	116—118	..	4 19 6	236,476	Stk.	Feb. 24	5	Tynemouth, 5 p.c. max.	112—113*	..	4 8 6
65,500	,,	Dec. 30	4	Do. 4 p.c. Deb. . . .	96—98	..	4 1 8	255,636	Stk.	Feb. 24	6⅜	Wands-) B 3½ p.c. .	140—142*	..	4 15 1
								85,766	,,	Dec. 30	3	worth) 3 p.c. Deb. Stk.	73—75	..	4 0 0

Prices marked * are "Ex. div."

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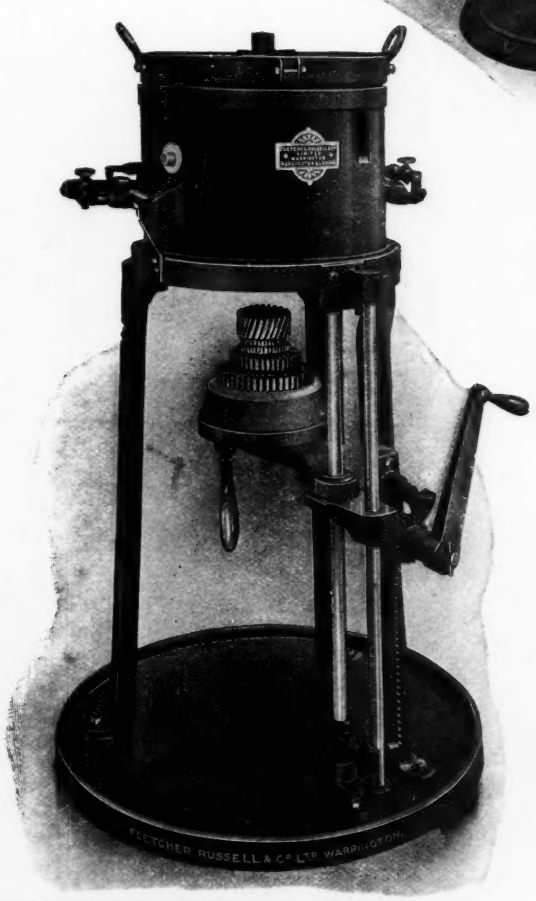
FLETCHER, RUSSELL & Co., Ltd. — THE PIONEERS.



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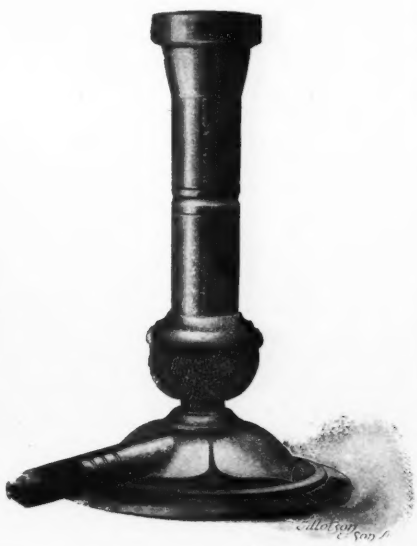

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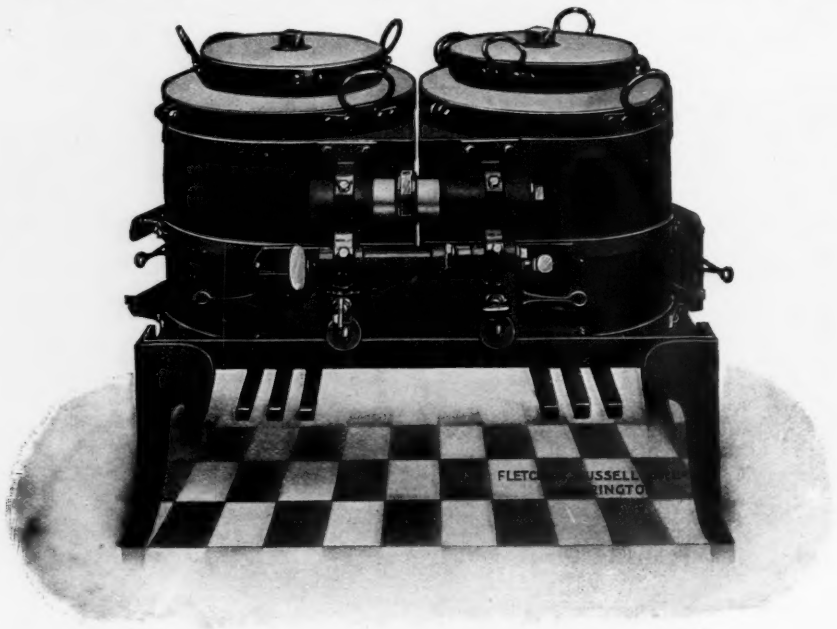

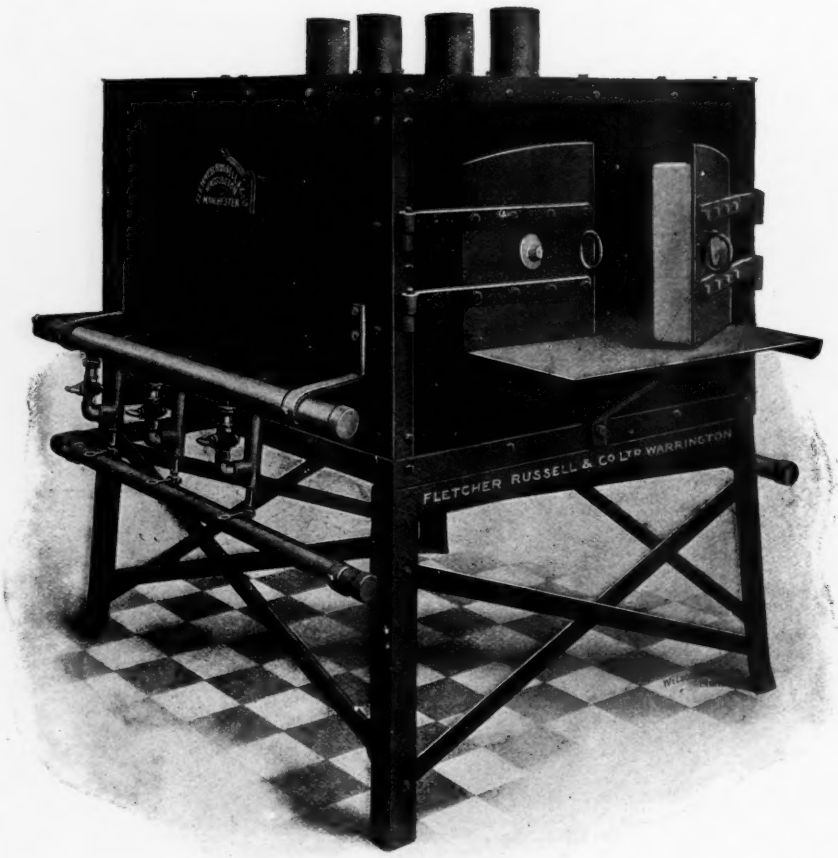

THE FIRM WITH OVER FORTY YEARS' EXPERIENCE IN SPECIAL GAS HEATED APPARATUS.

See inside pages.

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